

PAPERS AND ORIGINALS

Psychiatric Treatment of Eczema: A Controlled Trial

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Summary

Seventy-two patients with eczema were randomly allotted to one of two treatment groups: A, those receiving dermatological treatment only, and B, those receiving the same dermatological treatment plus psychiatric treatment, limited where possible to four months. Cases were followed up at six-monthly dermatological assessments, 57 (79%) for 18 months. The findings suggest that in the presence of overt emotional disturbance, of new psychological or psychophysiological symptoms preceding the rash by up to a year, and of high motivation for it, brief psychiatric treatment improves the outcome in eczema (the proportion clear at 18 months was about doubled), whereas in their absence such treatment may worsen it, especially in the short term.

Introduction

Many factors may contribute to the onset and course of eczema, among them heredity (constitution and type of skin), local factors (external irritants, allergies, trauma and infection, and gravitational stasis), and psychological factors. The study of 82 adults with eczema, of which this paper is a part, led one of us (Brown, 1970) to the view that emotional disturbance precedes the onset of eczema in most cases and is diagnosable as a psychiatric illness in a high proportion. In others, particularly those with personality structures predisposing to somatic rather than psychological reactions, the eczema represents a substitute for rather than a concomitant of psychological "illness." Obviously one or more causes may coexist, and it is our experience that there is often a clear interaction between psychological and local factors such as allergic sensitization.

A review of the literature shows that the results of psychiatric treatment of eczema vary a great deal from study to study, but that most trials were inadequately controlled. Restricting oneself to the four studies which include some controls, however unsatisfactory, one can tentatively conclude that chlorpromazine and opipramol improve the outcome of some of the eczemas—diagnosed as eczema, atopic eczema, neurodermatitis, and seborrhoeic dermatitis (Lester *et al.*, 1962; Privat, 1964); that in atopic eczema in childhood correction of the maternal rejection factor by didactic psychotherapy of the mother is helpful (Williams, 1951); and that individual psychotherapy with no local treatment may be very helpful in cases diagnosed as eczema, seborrhoeic eczema, or neurodermatitis (Couper and Twiston Davies, 1954).

Selection of cases is probably one of the most crucial factors. There is no real evidence that response to treatment depends on the type of eczema (apart perhaps from those involving a strong local or constitutional factor, as in contact or atopic eczema) but a lot to suggest that psychopathology and the degree of overt psychological distress are important variables. The relationship between therapist and patient and the motivation for treatment are being increasingly recognized as significant factors, not only in psychiatry. Ideally then all these should be taken into account in any trial of psychiatric treatment in the management of eczema. Also needed are adequate controls and numbers, clear criteria of benefit, blind assessment, and a period of follow-up which allows for "spontaneous" fluctuations in the course of the eczema. An attempt was made in this study to fulfil these requirements.

Patients and Methods

Eighty-two patients were seen in the skin outpatient department of the Middlesex Hospital during a two-year period 1963-5 and diagnosed by one of us (F.R.B.) as suffering from an eczematous condition, classified according to Pillsbury (Pillsbury *et al.*, 1956). Cases were unselected consecutive referrals, mainly from general practitioners, but were limited to those aged 18-65, of more than six weeks' and less than three years' duration, and with at most one previous attack. The age limit was to facilitate matching, and to increase the chance that the limited psychiatric treatment available would be appropriate. By excluding very transient or chronic disorders we hoped to get a clearer picture of the relation between rash and emotional disturbance and to

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make a more effective test of psychiatric treatment. Therefore there were no cases of infantile eczema, and only one case of atopic eczema.

Each case was examined psychiatrically before a random code was broken and the patient was allotted to group A or B, determining whether he had dermatological treatment alone (from F.R.B.) or in combination with psychiatric treatment (from D.G.B.). Examination comprised two semistandardized interviews lasting about an hour each and psychological tests. Among these were a widely used questionnaire inquiring into awareness of emotional disturbance, the Cornell Medical Index, sections M-R (Brodman *et al.*, 1949, 1952, 1954, 1956; Culpan and Davies 1960; Culpan *et al.*, 1960; Brown and Fry, 1962; etc.), and specially devised scales for use by the psychiatrist: a symptom rating scale for the detailed assessment of evidence of psychological symptoms, and a motivation rating scale for assessing motivation for psychiatric treatment (details of which are available on request to D.G.B.).

After a while it appeared that some patients regarded the full psychiatric assessment as treatment, so from Case 65 onwards we changed the procedure; the code was broken *before* psychiatric assessment, and those allotted to group A were not seen by the psychiatrist and merely had three questionnaires administered by a secretarial assistant. This provides us with a subgroup (A2) of eight patients in whom to assess the possible therapeutic affect of the fuller psychiatric assessment. However, because there are no clinical psychiatric data for them, they could not be given a psychiatric diagnosis, etc., nor provide information for such things as the symptom rating and motivation rating scales; hence the short-fall in some of the tables.

Table I shows that randomization resulted in quite closely matched groups with regard to age, sex, and social class. Tables II-IV show the dermatological and psychiatric diagnoses of the patients who were followed up and a judgement of the vulnerability of their personalities. With regard to the type of eczema and vulnerability of personality the two groups seem well

TABLE I—Age, Sex, and Social Class Distribution in Group A (Dermatological Treatment alone) and Group B (plus Psychiatric Treatment)

	Group A (N 38)	Group B (N 34)
Mean age (range)	41.4 (18-64)	43.1 (21-62)
Sex { Males	15	16
Females	23	18
Social Class { I	3	1
II	11	6
III	21	23
IV	2	4
V	1	0

matched. The larger number of cases of nummular eczema in group A is not significant (χ^2). However, group B has a lower proportion of cases with a clear and unambiguous psychiatric state, which is statistically significant ($P < 0.01$), though in the trial this might work against the efficacy of psychiatric treatment rather than aid it.

TABLE II—Classification of Eczema Patients in Non-psychiatric (A) and Psychiatric Treatment (B) Groups according to Pillsbury *et al.* (1956); and Dermatologist's Assessment, after 6 Months, of Contribution of Local Factors

Type of Eczema	A (N 38)	B (N 34)	Total (N 72)
Contact (primary irritant)	0	0	0
Contact (allergic)	5	6	11
Atopic	0	1	1
Seborrhoeic	1	2	3
Nummular	6	1	7
Lichen simplex	1	1	2
Stasic	3	2	5
Chronic, obscure origin	11	13	24
Hand or foot eczema	11	8	19
Assessment by dermatologist, after 6 months, of part played by local factors in genesis of eczema:			
Clear	8	8	16
Doubtful	13	13	26
None	17	13	30

TABLE III—Psychiatric Diagnoses of Eczema Patients in Groups A and B (Excluding Group A2)

Psychiatric Diagnosis	A (N 30)	B (N 34)	Total (N 64)
Anxiety state	4	1	5
Mixed anxiety and depressive state	15	8	23
Depressive state	3	4	7
Tension state	1	1	2
Doubtful	2	9	11
None	5	11	16

$\chi^2 = 6.839$
 $P < 0.01$
(d.f. 1
1-tail)

TABLE IV—Vulnerable Personalities in Groups A and B (Excluding Group A2)

Evidence Judged to be	A (N 30)	B (N 34)	Total (N 64)
Clear	20	22	42 (66%)
Mild or doubtful	7	12	19
Not apparent	3	0	3

DERMATOLOGICAL TREATMENT

Dermatological treatment was given to all patients. It consisted of the careful elimination of identifiable allergens and irritants, the application of steroid ointments and creams (mainly beta-methasone) or zinc cream with ichthyol or tar, and, if required, antibiotics and antiseptics. Treatment was continued until recovery or throughout the 18-month period of follow-up.

PSYCHIATRIC TREATMENT

The duration of psychiatric treatment was kept to four months where possible, because of the limited time available. A plan of treatment was devised for each patient according to whether or not there was overt psychiatric disturbance and in line with the literature and general psychiatric practice in this country (Hill, 1965)—treatment of symptoms, amelioration of immediate stresses and modification of stress reactions, and focal rather than extensive psychotherapy aimed at influencing basic personality. Awareness, ventilation, and verbalization of emotional disturbance was encouraged, and expression of resentment and hostility was particularly encouraged. Factors preventing awareness or ventilation were elicited, and the reasons (current and historical) for problems being difficult to deal with directly and successfully were explored. It was aimed to change situations of conflict or frustration, if possible through assertive action by the patient. When psychological symptoms were present the possibilities were considered of treating any neurotic conflicts with brief focal psychotherapy and of reducing emotional disturbance with appropriate antidepressants or tranquillizers. Progressive relaxation exercises (Jacobson, 1938) and hypnosis with suggestion of reduction in itching were also used with some patients, mainly those without obvious psychological symptoms and whose defences against awareness of emotional disturbance were too great or precarious. The treatments given are shown in Table V.

TABLE V—Psychiatric Treatments Given

Psychotherapy	7
Drugs	5
Psychotherapy + drugs	21
Antidepressants	18
Tranquillizers	16
Hypnotics	5
Progressive relaxation	4
Hypnosis	5

FOLLOW-UP

Follow-up was carried out at 6, 12, and 18 months from entry into the treatment trial by both dermatologist (F.R.B.) and psychiatrist (D.G.B.). Only the dermatological assessments were "blind." At each dermatological assessment progress since the

TABLE VI—Numbers of Patients Assessed by Dermatologist at 6, 12, and 18 Months

	Total (N 72)	Group A (N 38)	Group B (N 34)
All 3 times	45 (63%)	22	23
6 months	61 (85%)	31	30
12 months	53 (74%)	27	26
18 months	57 (79%)	29	28

initial examination was rated as: 1, full recovery; 2, great improvement; 3, moderate improvement; 4, unchanged; or 5, worse.

Seventy-two (88%) of the 82 patients admitted to the study were followed up, but for five (6%) only self-ratings were available as they did not come to the clinic (four in group A, one in group B). Thirty-eight were in group A and 34 in group B (Table VI). The smallest proportion seen at any one time was 74%. (Of the 10 patients not followed up, one in group B died from cancer a few months after starting treatment; one in group A was withdrawn from the trial because her condition was judged independently to require urgent psychiatric treatment; and eight defaulted, four in each group.) Self-rating reports were available for at least one assessment period for all patients included in the follow-up, but there was often considerable discrepancy between the ratings of dermatologist and patient (correlation by Kendall's tau test was in the region between 0.50 and 0.66). The self-ratings were, however, available, in the absence of anything better, for doing as full an analysis of variance as possible (see below). It was felt that the dermatologist's ratings would be more objectively reliable, and that the clearest criterion would be whether or not the skin was clear of eczema on examination. Consequently, for all but the analysis of variance, the results relate to 67 patients (34 in group A, 33 in group B).

HYPOTHESES

(1) Psychiatric treatment improves the outcome in cases of eczema independently of the degree of overt psychological disturbance. (2) It improves the outcome only when there is overt psychological disturbance. (3) It improves the outcome particularly when emotional disturbance is "highly relevant" to the eczema—for example, onset of new psychological or psychophysiological symptoms precedes the rash by up to one year. (4) It is more beneficial when patients have a high motivation for it and may be harmful when motivation is low. Conversely, withholding psychiatric treatment when motivation is high worsens the outcome.

Results

EFFECT OF PSYCHIATRIC TREATMENT REGARDLESS OF DEGREE OF OVERT EMOTIONAL DISTURBANCE

The overall outcome of eczema with (group B) and without (group A) psychiatric treatment is shown in Fig. 1. As time goes on group B seems to have the advantage, but the differences are not statistically significant on a χ^2 test. Moreover, it is possible that the incomplete follow-up biases the results in favour of psychiatric treatment; of those who did not attend but answered the postal inquiry, a greater proportion of group A reported that their skin was clear, but the differences were not significant (Fisher exact probability test).

Though too much cannot be read into it as the numbers are so small, the fact that the subgroup A2 (who were not seen by the psychiatrist at all) did particularly badly suggests that full psychiatric assessment (initially and at follow-up) has some therapeutic value, which might have obscured the benefit of formal treatment in this trial.

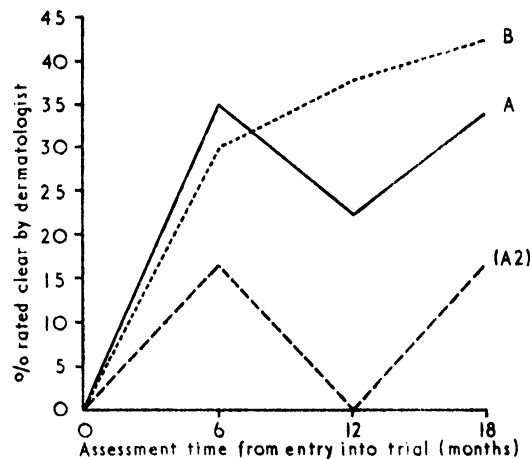


FIG. 1—Outcome of eczema, with (B) and without (A) psychiatric treatment.

EFFECT OF OVERT EMOTIONAL DISTURBANCE

Cornell Medical Index (M-R) Score.—It is generally accepted that women score higher than men on this questionnaire, in which a score of 10 is regarded as presumptive of emotional disturbance. This was true in the total eczema group studied, women having a mean of 10, men a mean of 7. It was therefore decided to count as high scorers those who scored above the mean for their sex. Patients with a high score who had had psychiatric treatment seem to have done particularly well at all three assessments when compared with high scorers who had not had such treatment (Fig. 2). However, with the method of analysing pairs of proportions (Edwards, 1965) none of the differences reach the 5% level of significance.

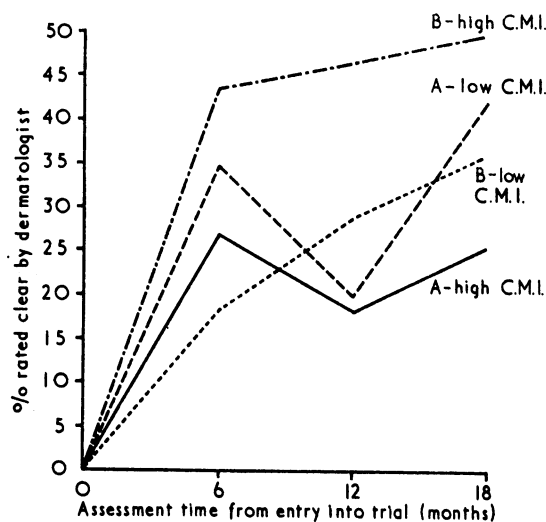


FIG. 2—Outcome of eczema, with (B) and without (A) psychiatric treatment, in relation to Cornell Medical Index (M-R) score.

Symptom Rating Scale.—Fig. 3 shows the results of dividing groups A and B into high and low scorers on the scale, the median score of 12 being used as the dichotomization point. The trends are similar to those on the C.M.I. and the difference at 18 months between high and low scorers in group A (using the same test)—respectively 17% and 64% clear—is statistically significant ($P < 0.01$). The dissimilarities are perhaps partly related to the fact that group A2 is not included (these patients

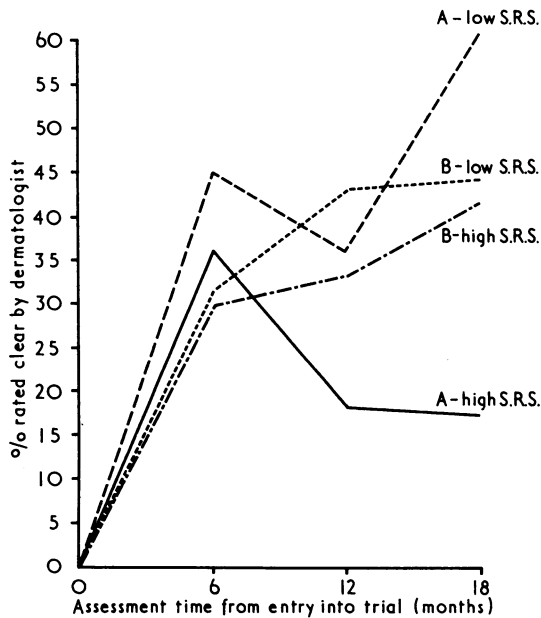


FIG. 3—Outcome of eczema, with (B) and without (A) psychiatric treatment, in relation to symptom rating scale score.

were not rated on this scale, and tended to do badly), and partly to the nature of the test (rating by psychiatrist rather than patient) and therefore less a test of what the *patient* wants to admit to.

EFFECT OF RELEVANT EMOTIONAL DISTURBANCE

The onset of new psychological or psychophysiological symptoms less than a year before the beginning of the eczema was used as a criterion of "relevant" emotional disturbance, it will be

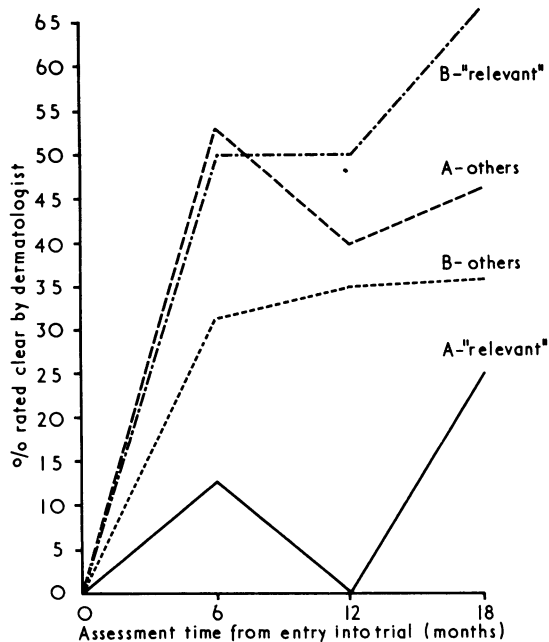


FIG. 4—Outcome of eczema, with (B) and without (A) psychiatric treatment, in relation to "relevance" of emotional disturbance. Definition: Patients with "relevant" emotional disturbance = those with new psychological/psychophysiological symptoms which precede the onset of eczema by less than one year. Others = those in whom such symptoms (1) precede the onset by a year or more, or (2) accompany or follow the onset of eczema, or (3) those in whom there are no new symptoms or the time relationships are not clear.

seen (Fig. 4) that in its presence psychiatric treatment seems to have been particularly beneficial. Again using the same test, the difference between groups A and B at 12 months—respectively 0% and 50% clear—is statistically significant ($P < 0.01$).

EFFECT OF MOTIVATION FOR PSYCHIATRIC TREATMENT

A motivating rating scale (M.R.S.) score of 6 or more (above the median score) was used as the criterion. From Fig. 5 it seems that psychiatric treatment was much more beneficial in eczema when motivation was high, and this may be particularly true in the short term, the differences being greatest at six months ($P < 0.05$), and gradually declining thereafter. In the long term,

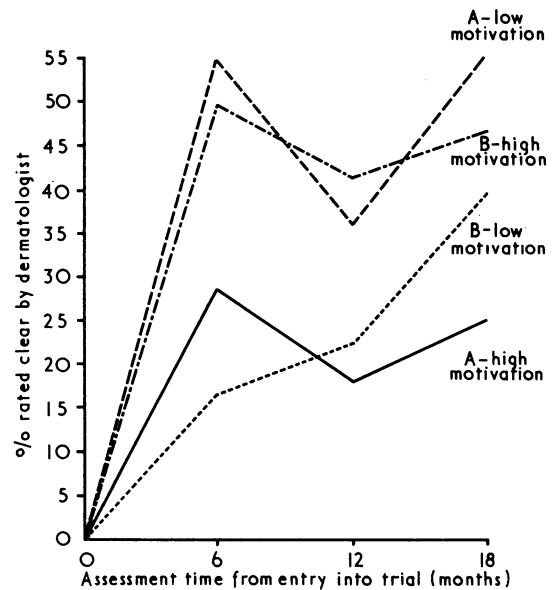


FIG. 5—Outcome of eczema, with (B) and without (A) psychiatric treatment, in relation to motivation rating.

especially, those who had high motivation for psychiatric treatment but did not receive it seem to have done particularly badly. Conversely, of the patients with a low motivation for psychiatric treatment, those who received it seemed to do particularly badly and those who did not seemed to do particularly well, a difference which declines markedly at subsequent assessment—significant at six months only ($P < 0.05$).

ANALYSIS OF VARIANCE

To check the above findings, and to take account of patients who did not attend for follow-up but answered the postal inquiry, an analysis of variance (Greenhouse and Geisser, 1959) was done. The dermatologist's five-point ratings were used, but when the patient did not attend for follow-up his self-rating, if available, was used as an approximation. Analysis was performed between tests (times), groups, individuals within groups, groups \times tests and individuals \times tests. Space prevents a detailed presentation of the results, but, in summary, only the factor of "relevant" emotional disturbance showed a statistically significant effect on the course of eczema ($P < 0.05$).

The profiles of the scores, however, were consistent with the above findings, indicating that over time the eczema of patients with a high level of emotional disturbance and high motivation for psychiatric treatment tended to improve progressively if they had had psychiatric treatment, but did not do so at all (C.M.I.) or got worse (S.R.S. and M.R.S.) if they did not receive such treatment. Further, while the eczema of patients with a low motivation for psychiatric treatment and a low level of emotional disturbance (C.M.I. and S.R.S.) tended to be

worse at six months when they had had psychiatric treatment, they seemed to improve more markedly over time than those who had not received such treatment. However, the eventual overall outcome was not so good, which supports the idea that short-term psychiatric treatment may be contraindicated in these patients.

A visual inspection was made of the data from patients answering the postal inquiry, as a separate check on the possibility that errors resulting from the incomplete follow-up were responsible for the trends in the graphs. This seems not to be so. In fact the trends were confirmed: those group A patients who reported their skin as clear were almost all low scorers on C.M.I. and S.R.S., and mainly poorly motivated for psychiatric treatment. Nor does the incidence of removable local causes account for the trends. The number of cases with clear or likely local causes was identical in groups A and B, and seemed to be more or less equally distributed among the subgroups. Moreover, of the 16 such cases in each group (A and B) who were seen at 18 months, six of the former (38%) and nine of the latter (56%) were clear, suggesting that even in the presence of such causes—the removal of which might be regarded by some as the only therapeutic task—psychiatric treatment might have something to contribute.

Thus hypothesis 1 was not confirmed, but the results tended to support hypotheses 2, 3, and 4.

Discussion

Despite the widespread view that psychological factors are important in eczema, cases tend to be sent to the psychiatrist as a last resort—all too often a resentful patient is passed on by a despairing dermatologist to a psychiatrist who feels impotent at the thought of another chronic case. Severe emotional disturbance, complained about as psychological symptoms or deduced from the mood and behaviour of the eczema patient, once it is recognized as of more than secondary significance usually leads to psychiatric referral. The greater problem is what to do about patients with minor degrees of emotional disturbance, complained about, observed, or merely suspected, and what are the benefits and dangers of psychiatric investigation and treatment in such cases.

The dermatologist is concerned to get the rash cleared as soon as possible, and (often rightly) suspects that the psychiatrist has other, perhaps conflicting, aims. Whereas the relief of psychological symptoms can often be brought about by using psychiatric drugs, improving the personal adjustment of an individual (or family) often necessitates facing disturbing truths that might temporarily increase both psychological symptoms and eczema. Where the problem or conflict is fairly localized psychotherapy might be possible over a few months, but where the trouble is a more generalized personality problem or an intractable life-situation effective psychotherapy might be protracted or impossible.

Psychiatric examination of the "unselected" group of eczema patients revealed a load of psychopathology, the nature of which is gone into elsewhere (Brown, 1967, 1970). Over one-third of the patients complained spontaneously of new psychological symptoms, mainly depression and anxiety. Nearly a third admitted to such symptoms when specifically asked about them, and in over three-quarters of these the onset of symptoms clearly preceded the eczema. (The remaining third, called superstable by one of us (D.G.B.), was not judged to be free of psychogenic factors, but to be very defensive and emotionally inhibited.) It could seem, therefore, that by providing a relationship and setting in which patients can unburden themselves, if necessary with a little encouragement and inquiry (and this does not require special psychiatric training), most eczema patients will admit to evidence of psychological stress or pathology. However, the therapeutic value of recognizing it is not clear.

While there is evidence from this study that some patients

who welcome the idea of talking about their problems experience "mere" psychiatric referral and examination as therapeutic, there is also a lot to suggest that benefit depends on a complex interaction between the patients' awareness of emotional difficulties, their personal resources and environmental situation, and their motivation for treatment and change. Finally, their developing relationships with both psychiatrist and dermatologist influence the outcome of treatment, for better or worse.

In the conditions of this study certain trends seem to have been confirmed by the end of the 18-month follow-up period. Short-term psychiatric treatment given *unselectively* does not significantly improve the outcome of the eczema. However, it approximately doubles the rate of clearance in the patients with more overt emotional disturbance and motivation for treatment, and such patients do consistently badly without psychiatric treatment. This supports the idea that severe emotional disturbance is a bad prognostic sign in eczema; but with psychiatric treatment, even short term, this is not so. On the other hand, such psychiatric treatment as given here seems to worsen the outcome in patients with little overt emotional disturbance and low motivation. The adverse effect on the eczema seems maximal in the first six months—that is, during the time they were being asked to face the unwelcome fact of psychiatric referral, their problems and conflicts. Perhaps one can conclude that, from the point of view of their eczema at least, such patients should not be pressed too hard. The others should be readily picked out by the sympathetic general practitioner or dermatologist, who could perhaps provide the short-term psychiatric treatment themselves, at least initially. Perhaps the psychiatrist should reserve his diagnostic and therapeutic skills for the problematical cases. In many cases it is likely that longer-term psychotherapy is indicated, if a therapeutic alliance can be established.

Criticisms of this study are easy to make, but we should like to point out certain faults, as they could be taken into account in further studies. (1) Distinguishing between eczema patients with and without overt emotional disturbance (or between any other subgroups) may require larger numbers of cases than were available here, to test adequately for statistical significance. Consequently we can only point to trends. (2) The limitation of psychiatric treatment to four months was arbitrary and may have led to poorer results in the resistant cases. (3) The combination of drugs and psychotherapy, though widely used in psychiatry, might in some cases be antagonistic, as it were suppressing and encouraging expression of affect simultaneously. (4) Extensive psychiatric assessment of both treatment groups may have a blurring effect. (5) Simultaneous but separate treatment by dermatologist and psychiatrist probably encourages defences of splitting, denial, and somatization by resistant patients. They might do better treated by one doctor.

It is clear that any future study of psychiatric treatment in eczema should take into account the variables of overtness of emotional disturbance, psychological defence structure, and motivation. Intensive study of a few cases is one important way of elucidating such factors. But the fact that all these (and others) are relevant, indicates the need, in any future controlled trial, for such large numbers of patients that co-operation between several centres seems desirable. Factorial analysis could then take into account such variables as types of eczema, characteristics of patients and therapists, and types of treatment with a rigour that was not possible here.

We wish to thank Professor Sir Denis Hill for his part in initiating and guiding this project; the Clinical Research Committee of the Middlesex Hospital for providing facilities at the Institute of Clinical Research; Mrs. E. M. Miller and Miss M. E. Goodall for technical help; Mr. Brian Everitt for statistical help; and Smith Kline and French Laboratories for generous financial support.

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Reliability of Patient Monitoring Apparatus

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Summary

Assessment of a patient monitoring system used in a general medical intensive care ward showed that the blood pressure subsystem was unreliable. The method used in this study is discussed in relation to the clinical requirements of patient monitoring apparatus.

Introduction

Most clinicians find that patient monitoring devices which seem accurate and easily operated in a research laboratory are less valuable in clinical practice, where they must be reliable as well as accurate. Studies which test only accuracy and reproducibility are therefore inadequate, and we have developed a simple system for estimating the long-term reliability of a monitoring device in a hospital ward. The present trial was carried out in a general medical intensive care unit, and the equipment used was the T.E.M. series II Monitron. The reliability of each subsystem was calculated, and we suggest what should be acceptable levels of reliability for monitoring systems used in intensive care wards.

Materials and Methods

The Monitron system of patient monitoring has been described elsewhere (Wolff, 1966; Rawles and Crockett, 1969). The series II Monitron is designed to measure respiratory and pulse rates, temperature, and indirect blood pressure. In measuring blood pressure use is made of the phase-shift principle. (De Dobbeleer, 1965), systolic and diastolic blood pressures being detected by an arm-cuff system. An attached printer unit automatically prints out the results at adjustable preset intervals. We have been using series II Monitron apparatus in the medical intensive care unit of Guy's Hospital (Clark *et al.*, 1971) as part of the clinical trials conducted by the Department of Health and Social Security and the Medical Research Council. It was decided not to study the system for measuring respiratory rate, because we had found that most patients tolerated the nasal transducer poorly.

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The pulse rate was recorded from the E.C.G. signal from three chest electrodes, and the temperature measured was that of the skin on the lower back. The E.C.G. signal was displayed on bedside oscilloscopes connected to each individual Monitron unit and on a large-screen slave oscilloscope. The nursing staff were already familiar with the apparatus, but they were given more intensive instruction before the trial began and they had also been routinely using the trial recording sheets for several weeks.

The trial began at 9 a.m. on 1 January 1970 and ended at 9 a.m. on 1 April. All patients monitored in the two Monitron beds during the three-month period were included. Special sheets were designed for recording the times of the patients' connexion and disconnexion from the apparatus and for noting a failure in any system and when it was corrected.

Since nurses in an intensive care unit are usually busy, it was thought desirable to have a 24-hour automatic check on the equipment's performance. The printer unit was therefore set to print the results every 15 minutes. Pulse rate and temperature readings were instantaneous values at the moment of printing, but the blood pressure value was that of the last measuring cycle, the blood pressure unit having been adjusted to cycle automatically every 30 minutes. Often, however, when the blood pressure reading on the indicator display unit was obviously inaccurate the nurse would manually initiate another measuring cycle by pressing the appropriate button on the blood pressure unit.

Previous observation had shown that the printer unit printed the displayed results without significant error, and inspection of the printer unit chart would indicate whether a "nonsense reading" was being displayed on the indicator unit. A "nonsense reading" was a printed reading which was most unlikely to have been correct. For example, all skin temperatures below 33°C were regarded as "nonsense readings," since experience had shown that such a reading meant that the thermistor probe had become totally or partially detached from the skin. From the blood pressure record it was simple to see when either the systolic or the diastolic blood pressure had not been recorded. Assessment of printed errors of pulse rate was more difficult, since the pulse rate changes more rapidly than other measurements, but records of grossly abnormal pulse rates which in retrospect were known to be false were penalized, as were deviations of more than 10 beats a minute when a patient was being paced with a fixed-rate pacemaker or on continuous demand.

The criteria used to record printed errors were also used by nurses to record failure of a subsystem, and monitoring hours were recorded as unreliable when a fault had been recorded on the trial chart by a nurse or when two or more printed errors were noted within the space of one hour. Errors