Acta Derm Venereol (Stockh) 1992; Suppl. 176: 32–33

ADASI Score: Atopic Dermatitis Area and Severity Index

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The scoring system for atopic dermatitis presented is based on determination by point counting of involved body areas. On body diagrams, involved areas are colour-coded according to the severity of the skin changes and evaluated by applying a transparent grid. To obtain the ADASI score, the area fractions are weighted and multiplied by the intensity of the itching. The scoring values obtained are analysed by trend-and-time series analyses. These methods allow a clear statistical evaluation in each individual case. In a study on the effect of borage oil on atopic dermatitis, the value of this scoring system and of the statistical single-case analytic methods could be demonstrated.
Key words: Area determination; Point counting; Trend analysis; Time series analysis.

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INTRODUCTION

The evaluation of therapeutic measures in chronic skin diseases such as atopic dermatitis (AD) is hampered by two problems. One lies in the fact that scoring for the assessment of disease severity is rather difficult. The other problem concerns the statistical analysis of the results obtained.

Scoring of AD has been a rather controversial issue in recent years. In the literature, scoring systems of varying complexity are advocated (1). The results of a comparative study between a simple and a more elaborated scoring system clearly showed the superiority of the simple one (2).

All scoring systems, however, suffer from the fact that it is difficult for the human eye to assess areas or area fractions. Such estimations by the 'rule of nine' seem too crude for dermatological purposes. Therefore, in most studies, reference areas are used rather than the skin status as a whole.

In therapeutic studies, another problem encountered is the randomization of the patients into groups and the subsequent testing for statistically significant group differences. Since the course of AD shows considerable fluctuation within each patient, as well as an often extreme variation between individuals, this large inter- and intra-individual variation hinders effective stratification, leading to the effect of comparing 'apples with pears'.

To solve the first problem, we have developed a scoring system based on the principle of point counting to facilitate more accurate scoring of AD. To cope with the second problem, we have employed time-series analytic methods to model and analyse the course of the disease in each individual patient in order to obtain maximum of information on the disease course and the impact of therapeutic measures.

METHOD

The ADASI scoring system has been described in detail elsewhere (3). Briefly, on diagrams showing the body with marker points from the front and the back, the involved areas are painted with three different colours according to disease serverity. If only slight erythema is present, with or without scaling, the area is painted green, for example. More severely affected skin with infiltrating erythema and more or less severe scaling is painted blue. Skin areas with severe inflammation, oozing and/or scaling or lichenification are painted red. By the way, this colour coding can be performed by the patient himself.

An evenly spaced square lattice grid (e.g. with a distance of 1 cm between the grid lines) is placed on the diagrams. The area fraction of each of the three severity grades of skin changes is then calculated by counting the points on each colour field, divided by the total number of points falling on the body diagram. This principle of area or area fraction estimation by point counting is both very old and very simple (4, 5). If the diagrams are always of the same size, the number of points falling on the body diagram has to be counted only once. Thus, the entire counting procedure takes only a few minutes, depending on the grid spacing. It should be noted that it is not necessary to count a large number of points. For practical purposes, a grid with about 100 points falling onto the body diagram (front and back view combined), is sufficent (4).

To obtain the ADASI score, the area fractions (expressed as parts of 1) are weighted according to the formula

$$\text{ADASI} = (1 \cdot A_g + 2 \cdot A_b + 3 \cdot A_r) \cdot (I + 1)$$

where A_g, A_b and A_r denote the fractions of the green, blue and red coloured areas. We have added the intensity of the itching I as a multiplication factor because of the impact itching has on the patient's condition. The severity of itching is assessed by the patient on a 0 to 5 analog scale.

This scoring system yields values between 1 (no disease, no itching) and 18 in patients affected very severely (100% skin involvement, most severe itching).

STATISTICAL METHODS

In our opinion, a chronic disease such as AD requires an analysis of its course in each individual case, at least in addition to common statistical methods used to compare the mean or the variances between groups of patients (6). To the best of our knowledge, however, no such methods have so far been employed.

The variable 'score' of disease severity, measured over a certain period, constitutes a time series (7). A large number of methods have been devised, that allow mathematical modelling of these time series, as well as considering the impact a therapeutic measure may have on the course of the disease (Fig. 1). If the interval between two consecutive measures is short, the value of the variable 2 is likely to be rather dependent on that of variable 1. In the case of AD, this means that the severity of the skin changes depends at least in part on that of the previous day. This autocorrelation of the variables has to be taken into account to select the appropriate trend or time series analysis method.

In a previous study on chronic urticaria, we were able to show the value of ARIMA (Auto-Regressive Integrated Moving Average) modelling when analysing emotional factors in this disease (8). In a placebo-controlled study on the effects borage oil rich in unsaturated fatty acids has on the course of AD, we have employed the simpler

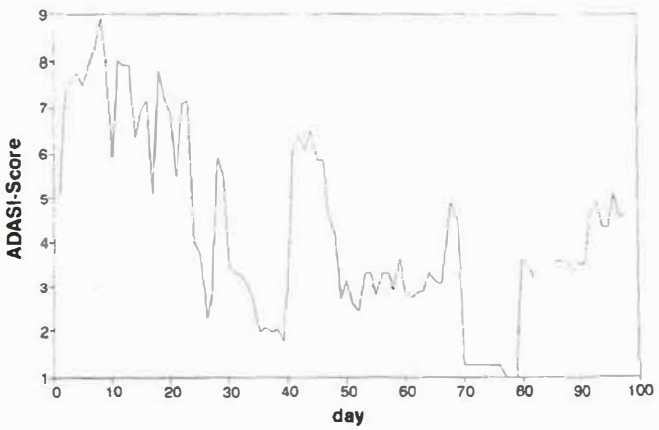

Fig. 1. ADASI score in a patient treated with borage oil.Trend analysis according to Cox & Stuart (9) yields a $\hat{z}$-value of 4.78, corresponding to a p-value of <0.0001, which clearly demonstrates the positive effect of the therapy on the ADASI score.

trend analysis method of Cox & Stuart (9). In contrast to the more sophisticated intervention analysis method proposed by Box & Tiao (10), the former does not require an a priori knowledge of the point where an intervention (here: effect of the diet) might take place. In this study we were able to show by trend analysis that borage oil helped 5 out of 7 patients treated. Of the patients in the control group – treated with the same amount of palm seed oil – only 1 in 5 showed some improvement (11).

To summarize: our ADASI scoring system, based on point counting, might considerably improve the scoring of AD. In addition, time-series analysis and trend analysis methods could provide valuable adjunct information and new insights into the course of this chronic disease in each individual patient. Furthermore, with these methods the effect of a therapeutic measure can be demonstrated on a sound statistical basis, thus allowing the definition of possible subgroups in which a particular therapy is effective.

REFERENCES

1. Hanifin JM. Standardized grading of subjects for clinical research studies in atopic dermatitis: workshop report. Acta Derm Venereol 1989; Suppl. 144: 28–30.
2. Costa C, Rilliet A, Nicolet M, Saurat J-H. Scoring atopic dermatitis: the simpler the better? Acta Derm Venereol 1989; 69: 41–45.
3. Bahmer FA, Schäfer J, Schubert HJ. Atopic dermatitis area and severity index: the ADASI score. Arch Dermatol 1991; 127: 1239–1240.
4. Weibel ER. Stereological methods, vol. 1: Practical methods for biological morphometry. London: Academic Press, 1979.
5. Bahmer FA, Smolle J. Morphometry in clinical dermatology. Acta Derm Venereol 1992; 72: 52–55.
6. Abrams BB. Atopic dermatitis: elements in clinical study design and analysis. Acta Derm Venereol 1989; Suppl 144: 15–19.
7. Gottman JM. Time series analysis. Cambridge: Cambridge University Press, 1981.
8. Bahmer FA, Kisling M. Emotionale Befindlichkeit und Urticaria – eine zeitreihenanalytische Studie. In: Kapp D, ed. Jahrbuch der Psychologie. Psychodermatologie. Heidelberg: Springer-Verlag [in press].
9. Cox DR, Stuart A. Quick sign test for trend in location and disperson. Biometrika 1955; 42: 80–95.
10. Box GEP, Tiao GC. Intervention analysis with application to economic and environmental problems. J Am Stat Assoc 1975; 349: 70–79.
11. Bahmer FA, Schäfer J. Die Wirkung von Borretschöl auf die atopische Dermatitis – eine zeitreihenanalytische Studie. Akt. Dermatol 1992; 18: 85–88.