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The Hyperventilation Syndrome

A Pilot Study on the Effectiveness of Treatment

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Summary: The aim of the study was to discover the relative effectiveness of four methods of treating patients suffering from hyperventilation attacks. The methods used were: breathing and relaxation therapy, hyperventilation provocation training, treatment based on influencing the factors which lead to the development of the syndrome, and drug treatment. The first three methods were demonstrated to be effective, whilst the fourth showed no signs of effectiveness. The condition of patients in the control group remained the same or deteriorated.

Hyperventilation is defined as an increase in the frequency and depth of respiration, leading to a loss of carbon dioxide in excess of the requirements of the metabolic ratio. Prolonged overbreathing, due to the loss of carbon dioxide, causes hypocapina and respiratory alkalosis, which in turn produce profound biochemical, neuromuscular, and neurovascular changes in the body (Lewis, 1953). The final result of all this is known as the hyperventilation syndrome; it appears as a variety of disorders which can effect almost any part of the body (e.g. the respiratory, circulatory, digestive, central and peripheral nervous systems) or the psychological state. The long line of specialists consulted by patients with the hyperventilation syndrome reflects the diversity of its symptoms, as do the many different names it has been given throughout history: DaCosta's syndrome, Neuro-circulatory asthenia, effort syndrome, and anxiety neurosis.

In its acute form, the syndrome manifests itself in the form of explosive attacks which the individual finds very frightening. He may fear for his physical or mental state, or feel a sense of impending doom (Lazarus & Kostan, 1969). Anxiety, panic, and fear are common symptoms in such patients who are referred to a psychiatric clinic.

It is precisely these elements of tension and anxiety which exacerbate the hyperventilation, and establish a vicious cycle (Lum, 1976). In fact, the syndrome is characterised by the establishment of multiple vicious cycles: hyperventilation causes complaints, complaints cause anxiety, anxiety causes additional hyperventilation, and so on; or, fear of recurring symptoms (anticipation anxiety) causes nervousness and tension, which in turn causes hyperventilation. The next development may be the onset of various phobias, particularly when the patient allows the anticipatory anxiety to determine or limit his daily activities. Complete social isolation or severe hypochondria are also possible.

Attacks may be precipitated by acutely threatening experiences or by events which, although seemingly trivial, occur to an individual who has been exposed to a long period of stress. Other precipitators may be actual physical disease or disturbance in the regulation of breathing (Folgering & Colla, 1978).

This investigation examined the effectiveness of four methods of treating patients suffering from hyperventilation attacks. The following methods were chosen for evaluation because they are the best known and most commonly practised.

(1) Drug treatment (Aronson, 1966)
(2) Hyperventilation provocation therapy (Compernolle *et al* 1979)
(3) Breathing and relaxation therapy (Lum, 1975; Kanfer & Goldstein, 1980)
(4) Stress reduction therapy (Waites, 1978)

These published results, along with practical experience of the application of these methods in the psychiatric clinic of a general hospital, led to the expectation that all four methods would prove to be effective. The objective of the study was, therefore, to discover which method could be considered to be the most effective treatment.

Method

Subjects: Forty patients, consecutively referred to the psychiatric out-patient department of the St. Hippolytus Hospital in Delft, The Netherlands were selected on the basis of the following criteria:

(1) The patient had to be experiencing at least one of the following:
   (a) Attacks of anxiety and/or panic, described as a feeling of oppression and the need to escape

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(b) fear of death or of losing self-control
(c) fear of fainting or becoming ill in the vicinity of others
(d) free-floating anxiety, described as inexplicable anxieties and fears

In addition, the patient had to be suffering from a minimum of 18 out of a total of 45 complaints that are commonly associated with the hyperventilation syndrome (see below), and had to have had at least one attack during a one month period prior to referral.

(2) The duration of symptoms had to be at least one month.
(3) Patients had to be between 18 and 50 years of age.
(4) Obsessive-compulsive neurosis, severe depression, organic conditions, and psychosis had to be absent

Procedure: Patients were randomly assigned to one of the treatment groups or to the control group, according to their order of referral to the out-patient clinic. Patients from each of the five groups were assigned to four therapists. Each patient received only one type of therapy throughout the three-month course of the investigation; treatment consisted of six fortnightly sessions.

Treatment: Prior to treatment each patient was given an explanation of the causes and patterns of the hyperventilation syndrome, and was then treated by one of the following methods:

Breathing and relaxation therapy: Breathing exercises were used to unlearn the habit of thoracic breathing and to train the patient to breathe by using the stomach muscles. These exercises enable the patient to control his rate of respiration and also stimulate the use of the diaphragm (Lum, 1976). Emphasis was placed on decreasing the rate of breathing in general by, for example, prolonging the pause between inspiration and expiration. Patients were taught to breath out more slowly and gently in order to decrease the amount of expiration.

Jacobson's method consisting of immediate contraction and gradual relaxation of different groups of muscles (Kanfer & Goldstein, 1980) was used as a means of self-relaxation. Patients were asked to do both the breathing and relaxation exercises daily throughout the three-month research period.

The hyperventilation provocation method, using a plastic bag: The patient was asked to breathe quickly and deeply, thus inducing a hyperventilation attack. He was then given instruction in how to terminate the attack himself by re-breathing his own carbon dioxide from a plastic bag. Instructions were given to repeat this procedure every day for a period of two to four weeks in order to help combat anxiety and the anticipatory fear of future attacks. (See Compernolle *et al*, 1979, for an extensive discussion of this method).

The stress reduction method: This approach aimed at dicovering and destroying the precipitators of tension and anxiety that have perpetuated the hyperventilation attacks. A functional analysis was used to reveal problem areas in the occupational, relational and family situations which cause stress. If these could be eliminated, it was expected that the attacks would disappear accordingly (Waites, 1978).

Drug treatment: The primary effect of medication is the suppression of tension and anxiety; its results and side-effects were discussed during the sessions, so that the therapist could determine future policy. The medication was prescribed in the following sequence:—

(a) 6 mg lorazepam per day
(b) up to 250 mg oxazepam per day
(c) up to 150 mg chlordiazepoxide per day, possibly in combination with 30 mg flurazepam hydrochloride
(d) 5 to 60 mg clopenthixol per day

The control group: Subjects in the control group were given the entire battery of tests, but no therapeutic methods were practised. Instead, a standardised interview was conducted, consisting of questions on early childhood experience and later life history.

Operationalisation: The instruments of measurement

The comparative effectiveness of treatment was measured using the following parameters:

(1) The severity of the hyperventilation complaints was measured by using the following check list of symptoms: Numbness or tingling of hands; dizziness; shortness of breath; feeling faint; headache; little stamina — tires easily; feeling unsteady; anxiety; dizziness sitting or lying down; pain in the chest; trouble thinking clearly; nervousness; light-headedness; palpitations; perspiration; nausea; trembling hands; sleeping problems; tightness in chest; cold shudders; numbness or tingling of feet; ringing in ears; hands tight, hard to open; feeling far away; blurred vision; lump in throat; cold, pale hands; difficulty talking; feeling unhappy; agitation; feeling of breathing too frequently; waking up at night short of breath; passing out, unconsciousness; frequent urination; numbness or tingling of face; sighing; numbness or tingling of tongue; feeling of unreality; crying without reason; double vision; diarrhoea; excited without reason; vomiting; dry mouth; shaking.

A five point scale with the response categories 'none', 'mild', 'moderate', 'serious', and 'very serious' was used to produce a total score (Compernolle *et al*, 1979).

This checklist is a compilation of those used in four major studies on this subject-Pitts, 1969; Weimann 1968; Lowry1967; Buitenhuis, 1976. In the absence of any other reliable and valid measure for diagnosing the syndrome, this choice of symptoms had to be considered adequate.

(2) The number of complaints was determined using the same checklist of symptoms. Patients were asked to put a tick by the symptoms they had experienced during the previous month.
(3) The frequency of attacks was determined by a self-registration monitoring assignment.
(4) The degree of depression was measured by the Zung Self-Rating Scale of Depression (Zung, 1965).

The tests were administered according to the schedule given in the table.

Results

A one-way analysis of variance was the statistical method used for processing the data. The independent variable manipulated by the researcher was the method of treatment, whilst the test scores on effectiveness provided the dependent

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TABLE

Time-table of the test administration

Pretest (1st week)	Intertest (8th week)	Posttest (14th week)	Follow-up (18th week)
1. List of complaints	1. List of complaints	1. List of complaints	1. List of complaints
2. Monitoring	2. Monitoring	2. Monitoring	2. Monitoring
3. Zung scale		3. Zung scale	3. Zung scale

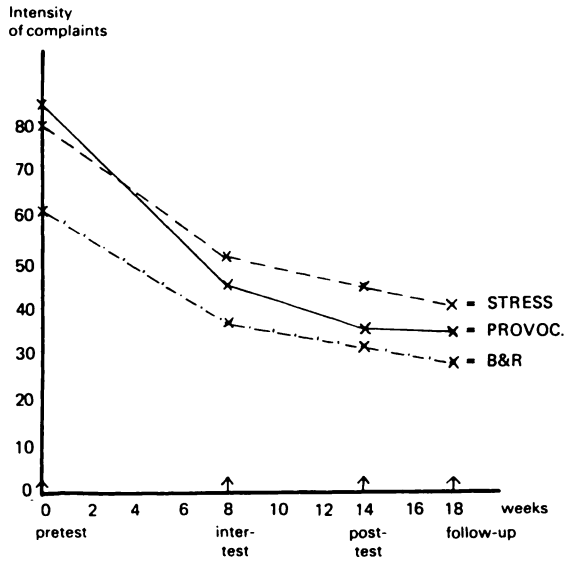


FIG 1.—Results on the variable "severity of complaints" for the three treatment groups.
The test variable "severity of complaints" was measured by the HV-list of complaints on the basis of a five-point scale. The maximal score on the list of HV items is therefore 180. The y-axis represents the mean score per treatment group.

variable. A 'repeated measures factorial design' was the computer programme used for calculation of the data.

The large percentage of dropouts from the control and medication groups (five out of eight per group), prevented calculation of their data, since conclusions could not be drawn from such small groups.

Only four subjects, out of a total of 24, dropped out of the other treatment areas: one from the stress reduction group, one from the breathing and relaxation group, and two from the provocation group. Reserve subjects were placed into these groups to maintain the original number of eight per group. This was done in order to simplify the statistical analysis and, although methodologically unsound, was considered justifiable on the grounds that this was a pilot study. However, since the original system of selection could not be maintained, our final conclusions must be treated with reservation.

The severity of complaints: This variable significantly decreased in all three treatment groups ($P < .001$). The most striking improvement was between the pre-and inter-test measurements, but there was no significant difference between the groups.

The number of complaints: This variable also decreased significantly in all three groups ($P < .001$), but again there was no significant difference between the groups.

The average frequency of the hyperventilation attacks: The treatment groups are not homogeneous on this particular variable since, at the time of the pre-test, there was a great difference between them in the initial frequency of attacks.

A significant difference was found in the average frequency of attacks between the breathing and relaxation group and the other two groups ($P < .001$).

The degree of depression: During treatment, there was a significant decrease in the degree of depression in all three groups ($P < .001$), but no significant difference was found between the three groups in the end result.

Discussion

This investigation provided evidence of the importance of professional treatment for patients suffering from hyperventilation attacks. A crucial finding was

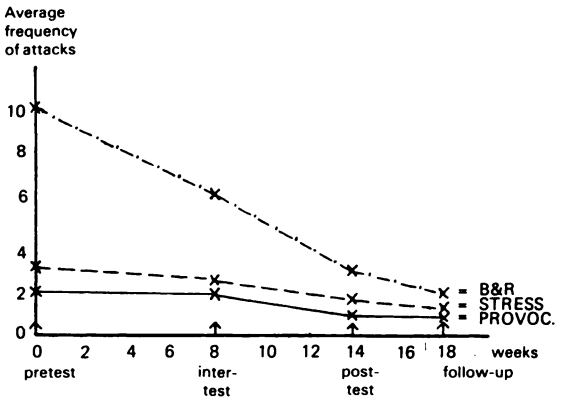


FIG 2.—Results on the variable "frequency of attacks" for the three treatment groups.
The test variable "frequency of attacks" was measured by a monitoring assignment on a weekly basis. The graph represents the mean number of attacks per group.

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that all three therapeutic methods—breathing and relaxation, hyperventilation provocation, and stress reduction—were effective forms of treatment. With all three methods, complaints decreased in both intensity and number, and attacks became less frequent, while related feelings of depression diminished accordingly. Beneficial results from therapy were realised within a relatively brief period of time (only 12 weeks in total).

The breathing and relaxation method appeared to be significantly more effective than the others in influencing change in the frequency of attacks. However, this result cannot be regarded as conclusive, since the groups showed a considerable difference on this variable. As this was a pilot study, the treatment groups were small and heterogeneous, and the statistical difference found here may be related to the particularly high frequency of attacks in the breathing and relaxation group prior to treatment. Therefore this method cannot be put forward as the most effective treatment, unless the same finding is duplicated using a larger sample.

Patients referred to a psychiatric clinic apparently expect a more profound kind of treatment than a new prescription for medication or an interview about their childhood. An unusually large percentage of patients (62.5%) dropped out of the control and medication groups, as compared to only 16.6% in the other treatment groups. An additional explanation for the high percentage of dropouts in the control and medication groups may be the therapists' lack of conviction in the value of these two procedures.

This also raised questions of ethics. Patients who are referred to a psychiatric clinic with severe and disabling symptoms should be given the best treatment available. Is it responsible, simply in the interests of a research project, to delay providing them with effective treatment? Or can it be argued that, having suffered from the syndrome for some years, they will not be overly affected by waiting a few more months? In order to minimise any negative effect caused by such a delay, patients were informed in advance that, should the method of treatment assigned to them prove ineffective after 18 weeks, they would be given other methods of treatment. The follow-up period was deliberately kept short, so that this could be done as quickly as possible. It should also be remembered that it was not known at the onset of the study which was the most effective form of treatment.

These research findings confirm the opinion arrived at by the authors, after several years' experience of

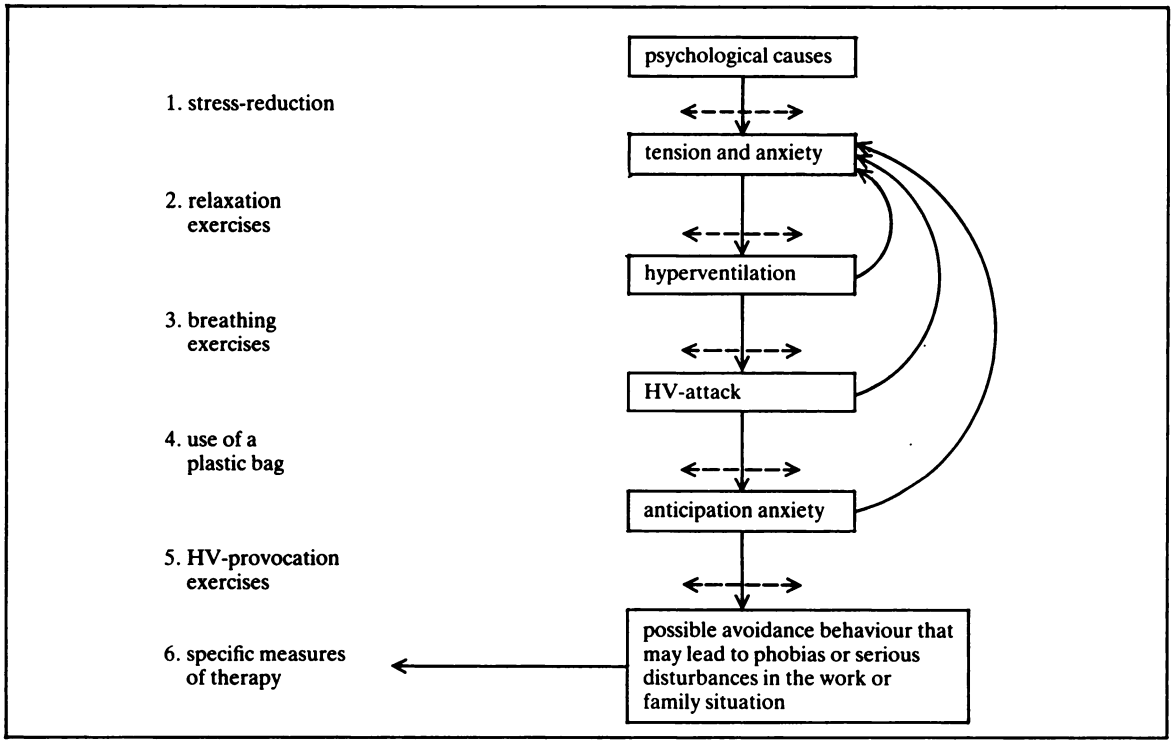


FIG 3.—A schematic representation of the HV-syndrome: the points of the different treatment strategies are shown.

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using these methods, both singly and in combination. An explanation of the success of the methods may be that they are each able to destroy the vicious circle; each one appears to have a different point of impact on the pattern that perpetuates the attacks.

This research would therefore seem to suggest that a combined application of the different treatment methods would be best:

(1) Treatment of the antecedent factors that have led to increased tension and anxiety and, finally, to the condition itself.
(2) Training in relaxation exercises that make it possible to reduce the level of tension in the body.
(3) Instruction in the technique of 'stomach breathing', which makes it possible for the patient to control his breathing pattern.
(4) Instruction in using a plastic bag in the event of an attack; this provides the patient with a concrete and practical tool.
(5) Exercises in hyperventilation provocation. This diminishes the patient's fear of new attacks, and therefore helps to decrease the anticipation anxiety.
(6) Specific therapeutic strategies may be required to treat consequences of the syndrome, such as phobic reactions.

This work has shown that a variety of therapeutic approaches to the syndrome may be equally effective, but further study is needed before any definite conclusions can be drawn. It is intended, therefore, to expand this pilot study into a more extensive investigation of the effectiveness of the various methods.

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