analysed to justify an assumption that similar real differences in the frequency of their use would occur in the general population of asthmatic patients. The effect of any one inhalant was found to vary greatly from patient to patient and on different occasions for the same patients.

Summary and Conclusions

An experiment was designed to compare the need for recourse to four inhalants—riddobron, brovon, neopine No. 2, and neb. adrenal. et atrop. co. (N.F.)—and their effect on a series of asthmatic patients.

No outstanding degree of preference was expressed for any one inhalant, and only the control inhalant was specifically commented upon adversely (see Table II).

The proportion of the total weekly periods used, which resulted in "good relief," "incomplete relief," and "no relief," were similar for all inhalants (except the control inhalant) (see Table III).

There were slight differences between the average number of times each inhalant was used per twelve-hour period in each week, but the evidence was not strong enough to justify the conclusion that similar differences would exist amongst the general asthmatic population.

The use of all the inhalants (except the control mixture) was discontinued an approximately equivalent number of times, for various reasons.

Measured objectively by the frequency of use, there was significant variation between the responses of patients to the same inhalants on different occasions; this was reflected in the subjective assessments of the same inhalant at different times and the usual inhalant when used as an unknown.

Each inhalant was given a poor assessment by a proportion of patients.

There was no difference of statistical significance between the inhalants as regards the incidence of side-effects (Tables IV and V). The side-effects most commonly noted during the investigation were dryness of the mouth, oro-pharyngeal irritation, unpleasant taste, and cough. Table VI shows that pleasantness is not incompatible with effectiveness.

It would seem from this investigation that, of the four inhalants specified, not one is outstanding, whether judged subjectively according to patients' opinion or objectively according to recorded frequency of recourse to it. Also, it became apparent that, although some asthmatic patients strongly affirmed their preference for one particular inhalant, that was not solely on account of any intrinsic value the inhalant may possess. The opinion may not be so favourable if the inhalant is first tested at an inauspicious time. The cheapness of the neb. adrenal. et atrop. co. is not accompanied by a corresponding feebleness of action.

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ASTHMA IN CHILDHOOD

A SURVEY OF THE WORK OF AN ASTHMA CLINIC IN HAMPSHIRE

BY

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Over a period of many years I have been increasingly impressed by the number of patients presenting at the Royal Hampshire County Hospital with clear physical signs of the effects of asthma, which no systematic or continued attempt had been made to prevent. I was therefore prompted to initiate a special clinic for asthma and other allergic diseases, with the purpose of the systematic investigation and continued management of asthmatic children. After consultation with colleagues and with the county medical officer of health, the clinic was begun early in 1947.

One advantage of an asthma clinic is the progressive increase in the number of patients who attend from year to year: the mere presence of such a special clinic in an area brings to medical treatment sufferers who might otherwise be content to continue without treatment until their health was irrecoverably damaged. In this clinic we have now investigated, treated, and followed up 209 children of school age and under. This preliminary report shows something of the pattern of the natural history of asthma, as affected by treatment, in a predominantly agricultural but partly urban area in Southern England. Adults suffering from allergic conditions are also investigated and treated in the clinic, but are not here considered.

Age and Sex Incidence

The grouping of patients according to their age at the onset of asthmatic symptoms is shown in the accompanying Table. It will be seen that in 84% these symptoms appeared in the first seven years of life.

Age at Onset of Symptoms of Asthma

	Age in Years																Total
	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	-16	
Boys	24	15	29	19	10	15	9	4	1	6	5	2	0	1	1	1	142
Girls	11	6	15	7	8	4	3	2	2	2	2	1	0	0	0	0	67
Total	35	21	44	26	18	19	13	7	3	8	7	4	1	1	1	1	209

Boys are affected more often than girls, in the proportion of 2:1 (142:67). Coke and Coke (1939), in 3,000 adult and child asthmatics, found only 8% more males than females, but they report that boys are affected more often than girls and show that the approach to equality in the overall figures derives from a preponderance of women between puberty and the menopause over men of the same age period. The Table shows the age of onset to be similar in boys and girls.

A definite history that a close relative had suffered from an allergic condition was obtained in 49% of our cases, a figure similar to that reported by Coke and Coke (1939) and Williams and Williams (1949).

Degree of Disability

Figures showing the average loss of school time are in course of collection, but their accumulation must necessarily be slow; on the one hand, not all the school time lost by asthmatic children is lost by reason of asthma, and, on the other hand, long periods of absence from school at a time antecedent to the diagnosis of asthma may be ascribed to some other cause. How great a handicap the

disease may be to a school-child is clearly shown by one girl patient who in three years lost 96 school days from asthma alone.

This sociological aspect of asthma is particularly important in the new educational system, which decides the future educational fate of a child by examination at the age of 11. The asthmatic child may by reason of his disability be excluded from a secondary education even though in fact the intelligence of a high proportion of asthmatic children is above average.

This effect on the education of the child would in itself be important enough to demand special attention, but there are other equally cogent reasons for a systematic attempt to make special arrangements for asthmatic children. Skeletal changes in the chest cage and spine arise chiefly in the first growing period—pigeon chest, kyphosis, kyphoscoliosis, contracted pectoral muscles, and round shoulders; and visceral effects—emphysema, fibrosis of lungs, bronchiectasis, right heart strain—inevitably lead to restriction of occupational opportunity and even to diminished expectation of life.

Associated Allergic Manifestations

The two commonest associated allergic manifestations were eczema and rhinitis, but in respect of rhinitis it was difficult to separate those cases which were purely allergic from those which were due to, or had an element of, upper respiratory infection.

Eczema.—Of the 209 cases, 57 (27%) suffered or had suffered from eczema. Of these 57, 35 were boys and 22 were girls; 33% of the girls and 24% of the boys had asthma and eczema coincidentally. The patients who suffered from both asthma and eczema could be grouped in two classes: those in whom the eczema had disappeared at about the age of 3 years, when they had cut the deciduous teeth; and those in whom the eczema persisted after the age of 3, or began after the age of 3, continuing sometimes into adult life. In 13 of 35 boys and in 19 of 22 girls eczema was present after the age of 3. Only 8 of these 13 boys and only 12 of these 19 girls had positive skin reactions. In 11 of these 13 boys in whom eczema persisted, exacerbations of the eczema and asthma did not occur together but alternated, but in only 6 of the 19 girls did the attacks behave in this way. It is difficult to express the distribution of the eczema in these cases mathematically in any detail. The commonest situations in the older children were the flexures of the elbows, wrists, and knees, and the fingers and toes; while in the younger children these areas were usually affected, and also the face, head, and neck. Two patients in the series, both of them boys, also suffered from urticaria.

Inheritance.—A definite history of a near relative who suffered from an allergic condition was obtained in 102 cases (49%)—a figure very close to that arrived at by Coke and Coke (1939) and Williams and Williams (1949). There were no significant differences in other respects between those who furnished a family history of allergic disease and those who did not.

Specific Skin Reactions.—Positive reactions were obtained in 106 children (51%). In some cases tests for specific skin reaction were repeated, but over the period under study the positive reactions did not become more numerous with increasing duration of the disease. By far the largest proportions of the positive reactions were associated with the inhalant groups, particularly feathers, down, horse-hair, and house dust. Only 16 children were sensitive to the pollen group, and most of these to grass pollen. Ragweed sensitivity, which bulks so largely in Gay's (1946) American series and which gives a high incidence in August and September, was not observed. One child was sensitive to milk protein.

Associated Chest Disease.—Clinical or radiological evidence of pulmonary disease other than emphysema was obtained in 21 patients (10.5%). Seven showed bronchiectasis, confirmed by bronchogram; four had calcified tuberculous foci; one proved to have active tuberculous

infection; four showed increased hilar markings, one had bilateral cystic disease of the lung, one had lobular atelectasis, two had hilar fibrosis, and one showed changes interpreted as due to congestion. The proportion of cases showing increased hilar shadows is similar, but the proportion showing other organic disease in the lung is substantially higher than in the smaller Yorkshire series reported by Royle (1952).

Whooping-cough.—In 96 (65 boys and 31 girls) there were definite histories of whooping-cough. In only 19 of the boys and in only 5 of the girls did asthma coincide with or follow immediately after the attack of whooping-cough.

Other aetiological factors are reflected in the specific forms of treatment thought to be indicated by the results of our investigations.

Treatment

The continued risk to which the asthmatic child is subject over a period of many years, the degree in many cases of the ultimate disability, and the effect of the disease on his education and future employment make necessary the closest investigation of the patient and perhaps his prolonged management. This is best undertaken at a specialized clinic where a clinician responsible for the patient as a whole can have the co-operation of his specialist colleagues and of the family doctor. Treatment is seldom dramatic, and it is often difficult to retain the co-operation of the child and parents. Attacks continue to occur from time to time during treatment, inducing depression and a feeling of hopelessness, to combat which the most constant encouragement, optimism, and interest are essential.

Drugs.—Phenobarbitone in doses of $\frac{1}{4}$ or $\frac{1}{2}$ gr. (16 or 32 mg.) according to age, once or twice daily, was prescribed for most of the patients and was continued for long periods. Many patients in addition were given antihistamine drugs such as mepyramine hydrogen maleate ("anthisan"), 50 mg. two or three times daily, diphenhydramine hydrochloride ("benadryl"), 25 mg. once or twice daily, or promethazine hydrochloride ("phenegan"), 10 mg. once or twice daily. Ephedrine, $\frac{1}{4}$ or $\frac{1}{2}$ gr. (16 or 32 mg.), was given for the relief of actual spasm. The standard method of prophylaxis against attacks has been the regular administration of phenobarbitone, but children who are constantly wheezy receive $\frac{1}{4}$ or $\frac{1}{2}$ gr. (16 or 32 mg.) of ephedrine regularly with the phenobarbitone. Where it seems suitable the mother is provided with ephedrine tablets, which she can give whenever an attack seems to be imminent.

Desensitization.—Children whose skin tests showed specific sensitivity were given courses of desensitizing injections if they were over 5 years of age. One child who was very sensitive to milk protein had this removed from her dietary, with a decrease in the severity and number of her attacks. In some cases feathers, pillows, eiderdowns, and other bed-clothes were removed from the bed or from the immediate proximity of the child. Only with the highly allergic was any change made in the more distant furniture of the room. In this way it was hoped that in most cases a very high concentration of protein particles would be avoided, in the air directly around the child, but in most cases it was felt undesirable to give the bedroom an abnormal appearance in case the child's feeling of invalidism should be increased. In children not highly allergic it was thought suitable to provide in this way a moderate concentration of varied protein material in the environment.

Treatment of Associated Nasal Disease.—Sixty of the children had had their tonsils and adenoids removed before being referred to the asthma clinic. A further 47 underwent tonsil and adenoid operations, being referred from the clinic to the ear, nose, and throat department. Forty children had antrum washouts and eight had other intranasal operations. In this group there is a certain amount of overlap, one child sometimes having more than one operation. Of 25 boys who had antral washouts 16 showed definite pus. Of eight girls similarly treated only four proved to have actual pus in the antrum. In the others the antrum was filled not with pus but by oedematous mucosa. All those children who

suffered from rhinitis were given decongestive drops. It is often argued that these drops may find their way to the bronchi and give rise to bronchial catarrh, but I have used them in children and adults for many years for the treatment of catarrhal and congestive conditions in the nose, and in no instance have symptoms of bronchitis developed after their use.

Physiotherapy.—A total of 119 children (57%) were found to be in need of remedial treatment in the department of physical medicine because of defective costal expansion, which in many cases was combined with dorsal kyphosis, round shoulders, and contracted pectoral muscles. It is easy to obtain the co-operation of the older children in breathing exercises. In children under the age of 6 or 7, however, it is possible to encourage breathing exercises only after they are first made breathless by exertion. If this is done one can assist expansion of the lower ribs and correct the child's habit of using the accessory muscles of respiration.

Psychiatry.—There were referred for psychiatric treatment 14 children whose obvious environmental disadvantages in the home or school surroundings seemed to be contributing to the frequency of asthmatic attacks. This number, of course, does not reflect the much higher proportion of children whose attacks may well have had a psychological trigger, developing as a form of escape or induced by the anxiety of parents or as an expression of a jealousy complex developed towards a younger brother or sister. The psychological pattern of the asthmatic child is often extremely complex. High intelligence may be masked by educational backwardness; basic psychological imbalance, perhaps an element in the genesis of the asthma, is difficult to distinguish from those psychological difficulties which arise from educational handicaps and often a semi-invalid regime, and a special and often not wholly natural parent-child relationship. The complexity of this aspect of asthma in childhood, no less than the importance of asthma as a handicap to education and mental development, is shown clearly by the following psychiatric report on an asthmatic child attending the clinic. This report is in many ways a fairly typical one in the more severe cases of the disease.

Psychologist's Report on a Boy, Aged 11 Years and 2 Months.—Stanford-Binet ("L" form, 1937) I.Q. 109, mental age 12 years and 2 months. His basic year is 8, while the scatter reveals a lack of fluency and educational retardedness. This backwardness is not due to a lack of intelligence, since he can perform well on the non-educational items at the 14-year-old level. His mental age ought to be at least 13 years and 2 months but for educational backwardness. Tutoring in the basic subjects is suggested, since his backwardness is obviously due to his absence from school because of asthma. He is of average adjustment, introvertively inclined basically, but has good emotional adjustment. Physical symptoms are most apparent in his personality assessment. He attempts to overcome this organ inferiority by being boyishly aggressive against authority. Some adjustment is necessary here, since it would appear that his aggression is a compensation for his strongly felt dependency.

Results of Treatment

Since no random control series is available for comparison, estimates of the effect of treatment are unsatisfactory. Of 179 children followed up for at least six months, 90 had no attack during the six months prior to the time of collection of these data, and 77 had markedly fewer attacks. Two children showed no improvement, and 10 stopped attending the clinic and were untraced. In the whole series there are 44 children who have been free from attacks for more than a year. The group treated by antihistamines and phenobarbitone together, and the group treated by antihistamines alone, were of course selected, and the results of these methods of treatment are therefore not comparable.

Commentary

The age and the sex incidence in this series of 209 children are comparable to those published by previous authors, and the importance of inheritance emerges from our figures

as from previous series. Few of the children's own parents have, however, been asthmatic. It seems to be only the allergic tendency which has a genetic relationship. As early as 1916 Cooke and Van der Veer published figures which showed that 48% of the subjects of asthma and hay-fever gave a positive family history, and they conclude that the tendency to allergy has a Mendelian dominant. Hanhart (1940) supported this contention. It is interesting to speculate how in one allergic subject asthma, in another hay-fever, in another rhinitis, and in a fourth eczema is the presenting feature, while in still other patients several or all of these may occur together or alternately.

I have observed that adults who suffer from severe hay-fever may be affected by asthma, which appears to be consequent upon the congestion produced by the hay-fever in the upper respiratory tract and the consequent respiratory obstruction. In other adults asthma has developed after the onset of infection in an antrum or from a badly deflected nasal septum. When an infected antrum is drained or a septal operation performed the asthma has often been relieved. Chobot, Uvitsky, and Dundy (1951) attach great importance to respiratory infection in children as a cause of asthma. The figures I have quoted support this opinion, but I find it difficult to decide from any available evidence, my own or that of others, whether allergy to infecting bacteria or the obstruction produced by inflammatory oedema is prepotent in this connexion. The relief of asthma often obtained in adults by the correction of a deflected septum persuades me that an obstructive element may be important in children too.

The influence of whooping-cough in the initiation of asthma is difficult to assess from my figures. Nearly one-half of the children gave definite histories of whooping-cough, but in only about one-eighth of them did the asthma coincide with or follow immediately after the attack. There is available to me no control series showing how many children in the general population give a history of whooping-cough. One can hardly deduce more than that whooping-cough may be one of the factors which precipitate the onset of asthma in an allergic child.

The high proportion (51%) who had positive skin reactions shows how important protein sensitization is in precipitating attacks.

Summary

A series of 209 asthmatic children attending an allergy clinic in Hampshire over the years 1947–51 is reviewed.

The pattern of asthma as it occurs in the children of the district is outlined.

Reasons for the establishment of a special clinic for the investigation and management of asthma are enumerated.

The importance of such a clinic in reducing the loss of school time and in anticipating the secondary effects which influence wage-earning and even length of life is argued.

So far as it is subject to statistical assessment, the effect of the clinic is examined.

The work of the allergy clinic, no less than the data on which my paper is based, depends to a high degree on the co-operation I have had from the county medical officer of health, Dr. H. L. Cronk, the medical secretaries and records staff of the Royal Hampshire County Hospital, the consulting paediatrician, those colleagues on whom I have depended for specialist reports and treatment, and the general practitioners who have co-operated with me in the management of patients at home.

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