(Campbell, 1937a), if the head is raised so that this edge is 10 cm. above the chest the efficiency of the mask is affected somewhat by draughts, so that with 6 litres of pure oxygen per minute the alveolar oxygen pressure is about 30 to 40 per cent. in place of 40 to 50. The chest acts as a damper to draughts, so that with the mask nearer the chest less oxygen is lost from the mask and fewer draughts of air enter the mask. In patients with a long neck the mask may be made longer and narrower without change in volume of inside space, but a simpler corrective is to partially close the bottom of the ordinary mask (see Table, Experiment 5).

Dr. R. V. Christie also kindly pointed out that draughts affect the efficiency to some extent. My results for the effects of draughts are given in the table, using an oxygen flow of 6 litres per minute in all cases.

With an air velocity of 40 feet per minute and the front edge of the mask 3 cm. from the chest, the alveolar oxygen pressure is about 40 per cent. (Experiment 2); with an air velocity of 160 to 200 feet per minute the oxygen pressure is lowered to about 30 per cent. (Experiments 1 and 3). The effect of such a draught is easily countered by fixing with adhesive tape a curtain of lint about 8 cm. in length all round the bottom of the mask, as in Experiment 4 in the table; the alveolar oxygen pressure is 45 per cent. in spite of an air velocity of 210 feet per minute.

In Experiment 5, with the head held up and the mask 10 cm. from the chest, the alveolar oxygen pressure is kept at a high level, 53 per cent., by closing the lower end of the mask with a cardboard grid, containing air spaces 1 cm. square alternating with portions of solid cardboard of the same dimensions. In Experiment 6, with lower air velocity, it is shown that no closure of the bottom of the mask is required. In Experiment 7d in the table, with an air velocity of 215 feet per minute and the lower edge of the mask 10 cm. from the chest and the bottom of the mask freely open, the alveolar oxygen pressure is lowered to about 29 per cent., but by means of the perforated cardboard grid or by closing two-thirds of the lower end of the mask with a piece of entire cardboard the alveolar oxygen pressure is raised to about 35 per cent. (Experiments 7a, 7b, and 7c). The curtain of lint is the most efficient means of protecting against draughts, but under ordinary circumstances the head of the bed may be provided with screens so that no special closing of the lower end is required. If the patient is restless and moves the head about much, then the bottom of the mask may be closed by one of the above methods to gain greater efficiency. Even at the worst, with the bottom of the mask open and in a draught, the patient is still getting oxygen in the lungs at a pressure of about 30 per cent.—that is, more than double the normal—with a flow of 6 litres of oxygen per minute.

For sedentary individuals Sir Leonard Hill and others have recommended air velocities of 3, 7, and 17 metres per minute, with air temperatures 15°, 18°, and 21° C. respectively. Under these conditions the mask gives about 40 to 50 per cent. of oxygen in the alveoli of the lungs with a flow of 6 litres of oxygen per minute.

Dr. A. L. Barach (personal communication) uses a small injector on the oxygen inlet tube so that some air is drawn in; this increases the flow through the mask, which is reduced in size. This draught helps to remove carbon dioxide and cools the face, but may be too rapid and so disturb certain types of patients. He uses also a whistle arrangement which gives warning when the

oxygen tube is kinked. He recommends the apparatus for patients and for passengers in aeroplanes (Barach, 1937).

Summary

1. The recent type of mask made of aluminium or transparent celluloid acetate for oxygen administration is described. Vision is now much wider. The comfort of the patient is considered.

2. With 6 litres of pure oxygen per minute the oxygen pressure in the alveoli of the lung is kept at about 40 to 50 per cent. under ordinary comfortable conditions of ventilation.

3. With 6 litres per minute of a mixture of 7 per cent. carbon dioxide and 93 per cent. oxygen the patient breathes about 5 per cent. of carbon dioxide, and the alveolar oxygen pressure is about 40 to 45 per cent. This or a similar mixture may be used when a respiratory stimulant is required.

4. The effects of draughts and of the position of the mask on its efficiency are considered. Simple means of counteracting effects of excessive draughts or excessive movement of the head are given.

I am indebted to Mr. C. Pergande, who acted as subject in the observations. The mask may be obtained from Messrs. Siebe, Gorman and Co., 187, Westminster Bridge Road, S.E.1.

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INTRANASAL APPLICATION OF POLLEN SOLUTION IN HAY FEVER

BY

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The object of this short article is to describe a method of treatment which I have found useful during recent years in relieving hay fever. I have employed it in numerous cases, either alone or in conjunction with other means; and I find it invaluable both as a preventive of attacks and for use in relieving an already existing attack.

Technique

The method is extremely simple, and consists in spraying the nasal cavities with a few drops of a sterile solution of grass pollen. The solution should be applied to the septum, the middle and inferior turbinates, and in particular to any hypersensitive areas. If this is done during the season in the case of a hay fever patient the immediate effect will be to produce a short bout of sneezing followed by the usual symptoms of hay fever. The effects of this artificially produced attack quickly subside, and the patient then becomes more resistant to the pollen in the air, with the result that, for several days to a week or more, many patients remain free from all symptoms of hay fever. The procedure may, if necessary, then be repeated.

The method above described may with advantage be used in conjunction with other means of treatment, and if there are any abnormally sensitive areas in the nose I make it a practice to treat these (Francis, 1934) before applying the pollen solution. If carefully carried out both

methods may be employed on the same occasion, with the result that not infrequently no further symptoms of hay fever will occur during the remainder of the season. The strength of the different pollen solutions employed depends on the severity of the symptoms in any particular case, as well as the weather conditions. In severe cases, in hot weather, small doses should be used.

Seasonal Treatment

In an average case seen during the hay fever season, with mild symptoms, an initial dose of 10 units of pollen solution may be given intranasally, and if this does not produce mild sneezing within five minutes the dose may be repeated. Subsequent doses may be increased by 25 per cent. at intervals depending on the length of time during which the patient remains symptom-free. In some cases no subsequent dose is necessary. It is convenient to arrange that the desired dose is contained in 0.25 c.cm. to 0.5 c.cm. of fluid, as this is a suitable amount to apply at one time. Necessary dilutions of concentrated pollen solutions may be made with carbolic saline (0.5 per cent. phenol in normal saline), and the dose measured in a graduated medium sprayer.

If on any occasion there is pronounced local reaction, the dose should not be increased at the next application, but the same dose again given, when the local reaction will be decidedly less than on the previous occasion. After this the next dose can again be increased by 25 per cent., as a rule without resulting in any great reaction. It is difficult to lay down any hard-and-fast scale of doses, as patients vary considerably in their response to different pollens, and also in their response to the same pollen under varying conditions of weather. In hot dry weather the local reaction produced by a given dose of pollen solution will be greater than that from the same dose received by the same patient in cold wet weather. All the above factors must be taken into account when considering the best dose for any particular occasion.

It is important, so far as is possible, to include in the pollen solutions employed all the grass pollens to which the patient chiefly reacts; for a patient may, after several applications, be made quite immune to a concentrated solution of one kind of grass pollen, although a different type of grass pollen of a lesser concentration sprayed into the nose may still produce sneezing and other hay fever symptoms.

It has constantly been observed that if the same dose of the same pollen solution has been sprayed into the nose of any patient on two or more occasions at intervals of a few days or a week, or even longer, the hay fever symptoms produced have become progressively less on each occasion.

Pre-seasonal Treatment

Before the hay fever season begins larger doses may be given, and in an average case doses of 100 to 200 units of pollen solution may be sprayed into the nose to commence with, followed by a 30 per cent. increase at intervals of two days or more. These doses do not as a rule cause more than slight transient symptoms of hay fever, and there is no doubt that the pre-seasonal intranasal application of pollen solution increases the patient's resistance to pollen. Mackenzie (1922) has reported favourably on this method, and Caulfeild (1922) has published good results from pre-seasonal intranasal inoculation with pollen ointment, although neither author claimed that the method by itself produced complete immuniza-

tion. I have never seen any untoward symptoms develop as a result of applying pollen solution in the way described, either before or during the hay fever season.

It is better to allow the artificially produced attack to subside naturally than to attempt to clear the nose immediately by the application of powerful vasoconstrictors; for in the latter case, although the nose may become temporarily clear, congestion usually returns after one or two hours, and it then remains obstructed for a longer period than if it had been allowed to clear naturally. As a rule, if left alone, all symptoms of the artificially produced attack completely cease in from ten minutes to one hour.

Conclusions

The advantages of intranasal inoculation in hay fever are that it can conveniently be used in conjunction with other methods, that it provides a means of giving relief to patients during an attack, and that it increases the resistance to pollen of patients who are intolerant of injection methods.

While it is not asserted to be a method which by itself results in complete cure, it can often be advantageously employed in cases where other means have failed or have only been partly successful.

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Clinical Memoranda

Treatment of Diphtheria

During the period 1935-6 I gradually came to think that the early deaths in cases of diphtheria could not be due to a toxæmic condition, but more probably to some underlying infection which was earlier in operation than the toxin of diphtheria. This view was taken by reason of the early cardiac involvement, such as the quick pulse, the onset of pericarditis, the haemorrhagic rashes, the early nephritis, and also the haemorrhagic edge of the diphtheritic membrane, to name but a few of the earlier symptoms noted in severe cases.

In support of this view were the more definite effects of the toxæmia of diphtheria, as instanced rather in the later stages (when it is admitted as a definite toxic condition), such as the slowing of the heart and the other paralytic symptoms. I thought that the more likely infection to produce these earlier symptoms would be caused by an organism common to the throat and associated with early cardiac and renal involvement. It appeared that the most likely organism—a common cause of faucial, cardiac, and renal disease—would be a streptococcus, probably one of the haemolytic type. In view of this, on January 22, 1936, I decided to try the effect of treating both a diphtheritic and a streptococcal condition.

The first case this was tried on was a girl aged 15 who was admitted to hospital on the second day of infection. She was cyanosed, with a rapid running pulse, with petechiae all over the chest and neck, and with extensive membrane surrounded by a haemorrhagic areola. She was given, on admission, 100,000 units of anti-diphtheritic serum and also 20 c.cm. of