having found any ill effects, have continued the practice. The seeds contain 8.57 per cent. of an active principle called strophanthin, which has been stated to be uncrystallisable. Merck, of Darmstadt, has, however, recently succeeded in finding very minute crystals demonstrable by a Zeiss one-sixth object glass. Strophanthin is generally met with in powder, and is virulently poisonous, one-fiftieth of a grain killing a good-sized dog immediately. The medicinal dose of this pharmaceutical edged tool is one-two-hundredth of a grain.

Up to a short time ago, when strophanthus was introduced to the medical profession by Professor Frazer, it was known as an arrow poison used by the natives of Central Africa for killing game, and, by the kindness of Messrs. Christie, I am enabled to show to the Section the native poisoned weapon. The stem of this arrow consists of a light reed, at the end of which is the bow-string notch, and at the other a light movable plug ending in a barbed arrow-head of soft iron. It is a curious coincidence that this weapon is not our ancient "clothyard shaft," but measures exactly one metre from point to notch; and it is strange how these ignorant savages happened to light upon this very scientific measurement. The poison is prepared by bruising the seeds between two flat stones until a reddish paste is produced, which is smeared upon the iron barb. If the animal at which the arrow is discharged is struck in the heart or in any other vital part, he is killed in the ordinary way; but if only slightly wounded he runs a short distance, stops short, has difficulty in breathing, foams at the mouth, and drops dead, the heart being found in such a state of tonic spasm as to entirely arrest circulation. The curious point is that the flesh is perfectly fit to eat, except the wounded part, which is cut off and rejected. The movability of the arrow-head is evidently to prevent the iron arrow-head, which is in savage countries valuable, from being dragged out and lost should the animal charge into the underwood, so common in tropical countries.

Looking to the therapeutical actions of strophanthus, I have found it a valuable cardiac tonic and strengthener of the heart-muscle in cases of typhoid fever with enfeebled first sound and tendency to cardiac failure. This is by far the best thing that strophanthus can accomplish; and the increment of the first sound both in length and volume, and increase of the radial pulse, was distinctly perceptible both to finger, ear, and sphygmograph, within fifteen minutes of taking the remedy. This clinical observation is interesting in relation to the paper read before this Section by Dr. Wild, of the Owens College, Manchester. That observer, testing the effect of different drugs on the contraction of muscle just removed from the body, proved by experiment that strophanthus causes marked contraction of the muscular fibre in ten minutes, a contraction which arrives at its maximum in fifteen minutes. It is important to find two observers arriving at similar conclusions, one at the bedside and the other in the pharmacological laboratory; in fact, the dose of strophanthus proper in each case can best be gauged by watching the effect upon the pulse or upon the heart's action. In oedema of the legs, the result of cardiac obstruction, great diminution of the swelling is obtained; and in cardiac obstruction generally great assistance is given to the labouring heart. In fatty hearts cardiac action is steadied and irregularity is diminished, but no permanent good is accomplished. Finally, strophanthus is in no respect a stimulant, but a pure cardiac tonic. It does not lose its effects by the system becoming habituated to it; on the contrary, its action from first to last is uniform. Contrary to digitalis it does not accumulate in the system, nor, while increasing cardiac muscular impulse, at the same time accentuate vascular muscular resistance, but acts upon the heart only. It encourages the action of the kidneys. In anæmia with weak heart, or anæmic murmur of the heart, it strengthens cardiac action and accelerates the action of the iron.

The following is a brief summary of some of the cases treated:—

CASE I.—F. S., aged 13, residing at 21, William Street, Dublin. A case of typhoid fever of a very bad type running to forty-two days, with two relapses and a continuous tendency to failure of the heart; complete recovery. This case was distinctly saved by the administration of the strophanthus, which was resorted to when quinine, port wine, and nourishment were evidently going to fail. The boy has now been removed to 17, Beechwood Avenue, Ranelagh, for change of air, and is quite cured.

CASE II.—A. S., aged 11, brother of the above. Severe typhoid fever running to twenty-eight days, but not of so bad a type. One relapse. Same tendency to cardiac failure, which was, however, entirely controlled by the strophanthus.

CASE III.—E. D., aged 17, a patient in St. Vincent's Hospital. Typhoid fever running to twenty-one days. Great cardiac depression in the middle of her sickness at once relieved by the strophanthus.

CASE IV.—J., aged 21, a patient in St. Vincent's Hospital. The

case was similar to the last one, and the strophanthus was used with the best effect.

CASE V.—M. C., aged 27, a patient in St. Vincent's Hospital. A case similar to the two preceding; similar benefit was derived from the strophanthus.

CASE VI.—M. H., aged 36, a patient in St. Vincent's Hospital. Excessive anæmia, with cardiac murmur. Rapidly cured by the administration of an ounce of aromatic iron mixture three times a day, along with ten minims of tincture of strophanthus and the same quantity of liquor arsenicalis. Looking to other similar cases treated with iron and arsenic only, it was evident that the strophanthus hastened recovery.

CASE VII.—R. K., aged 29, a patient in St. Vincent's Hospital, suffering from mitral stenosis with hypertrophied heart. Much difficulty in breathing, with frequent bleeding from the gums. Both these symptoms were relieved in a marked degree by the strophanthus, and he left the hospital much improved.

CASE VIII.—J. T., aged 40, a grocer, residing in Moore Street, Dublin, suffered from mitral stenosis, with great oedema of the legs, thighs, and scrotum, so great as to require acupuncture. His breathing was very bad, and he could not take exercise; indeed, he could hardly walk even after the surgical relief. He got great benefit from the strophanthus, and began to walk about. The oedema now commenced to return, but a renewal of the strophanthus appeared to check and reduce the effusion. He is now convalescent, can go about, and even attend a little to business.

CASE IX.—J. R., aged 72, a patient in St. Vincent's Hospital, suffered from fatty degeneration of the heart, accompanied by weak, rapid, and irregular action. His sphygmogram was very marked, and the diseased action of the heart was accentuated by the least exertion. The strophanthus steadied and strengthened his heart, and enabled him to walk about in comfort and to his great satisfaction. As soon as he stopped the medicine, the former state of things returned, and he left the hospital not improved.

THE ADMINISTRATION OF NITROUS OXIDE AND ETHER IN COMBINATION OR SUCCESSION.¹

By FREDERIC HEWITT, M.A., M.D. CANTAB.,

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OF all the anæsthetics with which we are acquainted, nitrous oxide is the most pleasant to inhale and the least likely to produce disagreeable after-effects. In addition to these advantages, experience has proved that in point of safety its superiority is equally conspicuous. When administered with certain precautions patients become rapidly, quietly, and deeply anæsthetised, and there is an absence of coughing, struggling, and excitement, symptoms by no means infrequently observed when other anæsthetics are employed. What, then, are the objections which render nitrous oxide inapplicable in ordinary surgical operations? The first of these is, in order that the gas may, under normal atmospheric pressure, produce its full effects, it must be administered in the absence of all air; and as the total exclusion of air throughout the administration of an anæsthetic is inadmissible save for a brief space of time, the period of anæsthesia from nitrous oxide is necessarily extremely short. It is true that by the careful admission of a small amount of air from time to time during the administration, anæsthesia, more or less complete, may be maintained for a comparatively long period; but there are so many practical objections to this procedure that it cannot be recommended except in certain cases. The second objection is that the apparatus necessary for the administration is cumbersome. Now both of these objections to nitrous oxide are hardly tenable when the administration is conducted immediately prior to full etherisation, for a little reflection will show that when nitrous oxide is thus used as a preliminary anæsthetic, not only will the period of inhalation, that is of exclusion of air, which is required be short, but the amount of the gas which is necessary will be much less than when the anæsthetic is administered without ether; and, therefore, the nitrous oxide apparatus will be more portable than when nitrous oxide alone is employed. Not only do the disadvantages connected with nitrous oxide thus almost entirely vanish when the administration is conducted as a step towards etherisation, but the objections which are attached

¹ Presented to the Section of Pharmacology and Therapeutics at the Annual Meeting of the British Medical Association in Dublin.

to the administration of ether may be similarly materially lessened by the preliminary administration of the gas. Briefly stated, the chief objections to ether are: firstly, its pungent taste and odour; secondly, the length of time which is often necessary for inducing anaesthesia, especially when air is freely admitted; and thirdly, the frequency with which excitement and struggling occur during the earlier stages of its administration. It is obvious that, if etherisation be preceded by the administration of nitrous oxide, the taste and odour of ether, and the other objections here referred to, will be completely removed. It may indeed be said that nitrous oxide supplies the deficiencies of ether just as ether supplies the deficiencies of nitrous oxide.

In the administration of nitrous oxide with ether, it may either be desired to obtain (a) an anaesthesia which is partly due to nitrous oxide and partly to ether, or (b) an anaesthesia due entirely to ether, the nitrous oxide in this case having only been used as a preliminary anaesthetic to obviate the drawbacks to ether.

In (a), the administration of nitrous oxide is conducted as under ordinary circumstances; but, towards the end of the inhalation, when the patient's respiration is commencing to become a little arrhythmic or stertorous, a small quantity of ether vapour is thrown into the gas current for the remaining portion of the administration. In this manner a "whiff of ether," as it is often termed, may be given, and the resulting anaesthesia will be due to both the anaesthetics. Three to ten inspirations of ether vapour usually suffice to appreciably prolong the anaesthesia of nitrous oxide, a procedure of great value in certain dental operations. Although it must be admitted that some slight headache, giddiness, or nausea is more likely to ensue after the production of this form of anaesthesia than when nitrous oxide alone has been used, such symptoms rarely result if only a small quantity of ether has been inhaled. The method is chiefly to be recommended in dental cases in which it is questionable whether the period of anaesthesia from nitrous oxide will suffice for the operation, and the patient prefers to run the risk of experiencing a little subsequent but temporary discomfort to a double administration of nitrous oxide. Patients should, as a rule, be told that they are about to take or have taken a little ether in addition to nitrous oxide. The frequency with which unpleasant after-effects arise will, *ceteris paribus*, be found to bear a kind of direct proportion to the amount of ether which has been inhaled; and it is therefore clear that, as a substitute for simple nitrous oxide, the combination of anaesthetics here described can hardly be recommended on all occasions. Still, it must not be forgotten that there are many cases in which it is of the greatest utility to administer a little ether at the close of an administration of nitrous oxide.

In (b), the objects in view should be: (1) to place the patient moderately deeply under nitrous oxide; (2) to gradually add ether vapour whilst the administration of nitrous oxide is proceeding, no air as yet being allowed; (3) to cautiously admit a small amount of air when the symptoms of nitrous oxide narcosis—muscular twitching and slight respiratory embarrassment—become manifest; and (4) to gradually increase the strength of the ether vapour, admitting a small amount of air from time to time, nitrous oxide narcosis thus becoming replaced by deep etherisation.

Numerous plans have been suggested and various kinds of apparatus recommended for administering nitrous oxide with ether. Comparative trials, extending over several years, of all the known methods have resulted in the adoption of an apparatus by means of which any desired combination of the two anaesthetics may be administered. It is nothing more than Clover's portable regulating ether chamber fitted with a bag for nitrous oxide, and with an arrangement in connection with the face-piece by means of which the contents of the bag may, at the will of the administrator, be either breathed out into the surrounding air or backwards and forwards into the bag. Clover's chamber is so perfect that for either adding a few breaths of ether to nitrous oxide (a) or for placing a patient deeply under ether after preliminary anaesthesia by means of nitrous oxide (b), it cannot be surpassed. In order that it may be used in each of these two ways, the arrangement of apparatus here advocated will be found very efficient. There are four separate parts to the inhaler: a simple face-piece (f); a valvular stopcock (v), by which the patient can be made to breathe as above described; Clover's ether chamber (E); and the gas bag (G).

If it be desired to give the two anaesthetics by the first method (a), the valvular stopcock is arranged so that the expirations shall escape; the ether chamber is turned to 0, and the gas bag is placed in communication with a pair of gas bottles (Fig. 1). When the administration of nitrous oxide is nearly completed, Clover's chamber is turned to 1 for from three to ten inspirations, the supply of gas being kept

up. When the face piece is removed, an anaesthesia varying from forty-five to ninety seconds can usually be depended upon.

If it be desired to administer nitrous oxide as a preliminary to deep etherisation (b), the apparatus should be arranged as in Fig. 2; and by using the valvular stopcock v (Fig. 1), the amount of nitrous oxide

Fig. 1.—Apparatus arranged for administering nitrous oxide with a few breaths of ether towards the close of the administration. As thus adjusted, air will be breathed through the apparatus in the direction of the arrows. Nitrous oxide is admitted by reversing v, and the gas is then exhaled at v throughout the administration. During the last few respirations the ether chamber is rotated to "1."

which the bag will contain will amply suffice. The apparatus thus becomes a portable one, and can be charged with a sufficient amount

Fig. 2.—Apparatus arranged for the administration of nitrous oxide and ether in succession, the nitrous oxide being employed as a preliminary anaesthetic. The actual adjustment here shown is that which is necessary during the transition from nitrous oxide anaesthesia to deep etherisation. Most of the gas in the bag having been allowed to escape at v (Fig. 1), the latter has been turned so that no more can pass out, and the patient is therefore represented breathing backwards and forwards into the bag, whilst ether is being gradually turned on. The administration has just reached that stage when a little air will be needed, and this can be effected by reversing the stopcock of the gas-bag for an inspiration or two.

of the two anaesthetics before the administration commences. It

is desirable whenever it is practicable, that all the arrangements for inducing general anæsthesia for an important operation should be conducted apart from the patient. The following is the best way to proceed. The apparatus is charged and placed out of sight in the room in which the operation is to be performed. The gas bag, filled with nitrous oxide, is detached from the rest of the apparatus, and placed near at hand beneath the bed or operating table. When the patient has been admitted, the face-piece, with the ether chamber attached, is accurately but gently adjusted; and, as the indicator is turned to 0, air free from ether is breathed through the apparatus. Confidence is thus gained, and whilst the patient is breathing air, the gas bag is noiselessly fitted to the ether chamber. Air is still breathed through the stopcock of the gas bag, but when the stopcock is reversed nitrous oxide is substituted, the patient hardly noticing the transition. When the bag is nearly exhausted, the valve action is stopped by reversing the stopcock next to the face piece, and the remainder of the gas then breathed over and over again, whilst ether is gradually but increasingly admitted by rotating the ether chamber. When some cyanosis and slight epileptiform movement testify to the presence of nitrous oxide narcosis, a little air is cautiously admitted by reversing the stopcock near the gas-bag for an inspiration or two. This allows the above phenomena to subside, and respiration to continue. Ether is now freely admitted, an occasional breath of air being allowed. When etherisation has become established, the remainder of the administration is conducted as with Clover's portable inhaler, which, indeed, the apparatus now becomes; and, if it be desired, the gas bag may be exchanged for the smaller bag usually supplied with Clover's inhaler. In this method of inducing anæsthesia, more complicated in description than in actual practice, there is a gradual transition from nitrous oxide narcosis to that of ether. When two separate face-pieces are employed; that is, when the patient is placed under nitrous oxide and is then suddenly forced to inhale strong ether vapour from an ether-inhaler previously charged, considerable embarrassment to breathing often occurs; and although it would seem that the temporary stoppage of respiration which is thus produced, is unattended by danger in experienced hands, it is nevertheless desirable to avoid such a strain upon the organs of circulation and respiration. By the arrangement above described, this objection to the successive administration of the two anæsthetics is obviated.

The parts of the inhaler here depicted can be so fitted together that nitrous oxide and ether can be administered separately, and by various methods, if desired. Messrs. Barth and Co., of 54, Poland Street, London, W., are the makers of the apparatus.

ON TINNITUS AURIUM.

Being an Abstract of an introduction to a Discussion in the Subsection of Otolgy at the Annual Meeting of the British Medical Association held at Dublin, August, 1887.

By THOMAS BARR, M.D., GLASGOW.

It is not my intention to place before you anything like a review of the etiology, pathology and treatment of this symptom, as such a course would lead us over far too wide a field of discussion. I cannot better occupy the time at my disposal than by considering shortly, and inviting the expression of your views upon, a few of the special remedies which are recommended or employed for the relief of this symptom. I exclude from consideration these remedial measures, whether operative or medicinal, which are directed to the removal of definite, well-recognised lesions in the external or middle ear, upon the existence of which the tinnitus may depend, and by the cure of which the tinnitus is fortunately often removed. Excluding the consideration of these or other forms of treatment intended to remove any palpable lesion or any evident pathological source in the naso-pharynx or ear, we shall inquire what other weapons do we possess, in addition to such modes of treatment, which may be efficiently employed for combating this symptom. We cannot, I think, do better than confer with each other as to the relative and actual value of the various means which have been proposed and tried in such intractable forms of tinnitus aurium.

The first of these to which I would beg to direct your attention is *electrical* treatment. Great diversity of opinion seems to prevail as to the value of this mode of treatment in tinnitus. I think that in the use of electricity to the ear the mode of applying the electrodes is of great importance. The plan of placing one electrode over the mastoid process or to the orifice of the ear, and the other in the hand of the opposite side, is not, I think, a good one. As thus applied, I believe

it to be less efficient and also more apt to excite giddiness or flashes of light. Any good results I have seen have been achieved by applying one electrode, in the form of a piece of sponge attached to the conducting wire and placed at the end of a vulcanite speculum, deep into the external auditory canal, even to the outer surface of the tympanic membrane; and the other, by means of a metallic ring at the end of a catheter, to the pharyngeal orifice of the Eustachian tube. In this way the galvanic current is passed, as completely as possible, through the middle ear. My impression is that any benefit derived is obtained more from the action of the electricity upon the middle ear than from its effects upon the internal ear, and that the benefit is mainly connected with its action upon the intrinsic muscles of the middle ear. We know the far-reaching influences of disturbance of the muscular apparatus of the Eustachian tube and tympanum upon the whole organ of hearing—first, upon the tension of the tympanic structures, and, secondly, upon the tension of the labyrinthine fluid, and the more efficiently we act upon these tubal and tympanic muscles the more likely are we to have good results. It is very much to be desired that this method of treatment should be placed upon a firmer and clearer basis than heretofore, and it is possible that the more general use of a galvanometer and rheostat may assist in the attainment of this result.

Another method of treatment to which I would ask your attention is the *Tonbehandlung*, tone treatment, brought recently before the profession by Prof. Lucae, of Berlin. Itard and Urbantschitsch had already pointed out the effects of objective sounds outside the body upon subjective sounds in the ear. Lucae has found that a striking influence is frequently exerted upon certain subjective sounds in the ear, mainly of a musical character, by bringing to bear upon them objective sounds coming from a tuning fork, if these objective sounds be as far removed as possible in pitch from the subjective ones. For example, if the sounds in the ear are high-pitched notes, such as hissing, ringing, whistling, a deep-toned tuning fork such as C or C¹ is employed; on the other hand, if the sound be low pitched, such as rushing, buzzing, humming, or a low-toned bell, then a tuning fork of a high pitch, such as C³ or C⁴ is used. The vibrating fork is applied either by placing the end of its handle into the external meatus, or, in order to augment the sound, the vibrations are passed through a resonator fixed into the orifice of the ear. The duration of the application may extend from one minute to five minutes, and in order to ensure a continuous sound the tuning fork may be connected with a magneto-electric apparatus. I think Lucae's observations are of great value, not only in relation to tinnitus aurium, but also to deafness itself. We know that patients frequently assert that the noises in the ear aggravate the deafness, and that if we could banish the sounds the hearing would be improved. Since Lucae's observations were published I have tried this tone treatment, and I have met with a considerable measure of success, and am of opinion that greater success is in store for this method of treatment. And, as confirming the impressions of patients in regard to the effects upon the hearing, I have found that the hearing power has been distinctly improved, both as tested by watch and speech, during the disappearance or subsidence of the sounds.

Probably of all medicines used for the relief of tinnitus, *hydrobromic acid* has been most extolled. I must confess, gentlemen, my success has not confirmed the panegyrics of some writers. I have prescribed it very frequently indeed, and the somewhat meagre results have been disappointing. Our Chairman, whose writings on the pathology and treatment of tinnitus have been so suggestive and interesting, is of opinion that this medicine acts beneficially by bringing about contraction of the dilated and engorged vessels of the labyrinth, through its effects upon the vaso-motor system of the labyrinth. I am afraid, however, that in the forms of tinnitus I am now describing we have generally to do not so much with dilated and engorged vessels but with the more serious condition of pressure exercised upon the nerve or labyrinthine fluid by condensed, thickened, rigid, or morbid tissue. Whether hydrobromic acid has the power of contracting dilated vessels in the labyrinth is not easy to prove. I can only say that in my experience it has only in a very few cases had the effect of removing or materially mitigating noises in the ear. This experience agrees with that of Politzer, expressed in his *Text-book of Diseases of the Ear*.

The *bromides*, especially bromide of potassium, have been, in my practice, more serviceable than hydrobromic acid. In doses of from half a drachm to a drachm at bedtime, bromide of potassium has not infrequently a distinctly mitigating influence upon the noises.

Pilocarpine, employed hypodermically, is undoubtedly useful in a certain proportion of cases. In my hands this remedy has been strikingly successful in several cases, although, alas! like other