cyanide of mercury in 1 per cent. solution, and the amount used at each injection was usually 20 minims, or about $1\frac{1}{4}$ gramme, though in some of the more severe cases I commenced with double this dose for the first one or two injections. At first the injections were employed every other day, but after a short time I decided to introduce them daily. A loop of bandage is first tightly applied round the upper arm, and selection is made of the most prominent vein in the neighbourhood of the elbow-joint; the skin in that region is rendered aseptic in the customary manner, and the needle is thrust into the vein, the syringe filled with the solution being attached to it; the bandage is then removed, and the syringe is emptied into the vein and then rapidly withdrawn; the finger is placed on the puncture for a few seconds, and the operation is complete.

As will be pointed out later, when dealing with the advantages of this system, it is absolutely painless, and with ordinary precautions perfectly devoid of danger.

The number of cases treated amounted to 76, and the number of injections made was upwards of 1,000. I need hardly say that I personally did not administer all these injections; they were carried out by my house-surgeons (Dr. Byles and Mr. Chopping), to whose care and skill I am indebted for the favourable results obtained. The cases treated covered a very wide field, and embraced nearly all the possible manifestations of the disease, from the simple and uncomplicated case to severe tertiary ulcerative lesions of skin and mucous membranes, malignant syphilis, condylomata, iritis, and chronic and relapsing syphilides. The number of injections necessary varied from 46 to 4.

As a result of the treatment, fifty patients were relieved, and by relieved I mean that they left the hospital absolutely free from syphilitic manifestations; sixteen improved under treatment, but still presented some traces of disease on their departure; four either refused to undergo the treatment, or had to be discharged from the hospital for misconduct, and in six instances the treatment had to be suspended owing to the impossibility of bringing the veins into sufficient prominence to allow of the injections entering them with any certainty, but in several of these cases great improvement was noted before the treatment was discontinued. It is a perfectly easy matter to determine if the injection has missed the vein by the pain, swelling, and bruising which shortly supervene, whereas the injections if properly effected are followed by no discomfort of any kind; moreover, the sensation produced by the needle moving freely within the lumen of the vein differs widely from that which is imparted should it only have entered the cellular tissue. As a rule, very little inconvenience was experienced by those patients in whom the injections missed the vein, but in a case in which the injections were made into the dorsal veins of the foot, which were somewhat varicose, a skin slough shortly supervened, leaving an ulcer which resisted treatment for some time. The vein usually selected was the median basilic, and no appreciable change could be detected in its walls, though in one case as many as twenty-three injections were introduced into each arm. As previously stated, the patients submitted to this treatment were all of them males, and it is hardly necessary to point out that, in dealing with women, greater difficulties would be encountered owing to the smaller size of their veins.

All of the patients under my treatment were admitted into the wards of the hospital; still I see no objection to the treatment being carried out in the out-patient departments. There was no selection of suitable cases, but every syphilitic patient who presented himself was submitted to the intravenous injections, whatever his bodily state, and a considerable proportion had resisted previous treatment in the out-patient department, and were transferred to the wards of the hospital in consequence; many of them were in a most unfavourable condition, being broken down by exposure, intemperance, and privations; nor were the patients very amenable to hospital discipline, and several of them left while still manifesting active signs of disease, whilst others had to be dismissed owing to breaches of regulations. In every case the diagnosis was made absolutely certain by the appearance of some secondary manifestation, and the treatment was never commenced until the nature of the case was satisfactorily proved. In a few cases diarrhoea supervened during the treatment,

but these attacks were transitory, and were possibly due to other causes; in some instances gingivitis occurred, but it was not so marked as after other methods of mercurial administration, and in no case was salivation noticed; the hygiene of the mouth was carefully attended to, and alum gargles were employed two or three times a day. In a few instances polyuria and very slight albuminuria were observed after the first or second injections, but these soon disappeared and did not necessitate any modification in the treatment; the only other remarkable feature to be recorded is that many of the patients experienced a metallic taste in the mouth immediately after receiving the first few injections.

From the tabulated list I have extracted a few of the more severe cases as illustrating the effect of this treatment:

Case 1 was that of an extensive and relapsing rupial eruption in a man, aged 22, who had been in the hospital under treatment by inunctions and iodides for upwards of three months. Under this treatment the symptoms cleared up temporarily, but after a month a relapse took place, and the rupial ulcers reappeared. In the course of the next three months forty-six injections were administered, and at the end of that period no trace of disease remained.

Case 5 was one of a seriginous tertiary syphilide over a large surface of the trunk and chronic superficial glossitis. After nine injections the syphilide had disappeared, and the condition of the tongue was much improved.

Case 22 was a patient with tertiary ulceration of the glans penis of six months' duration, which had resisted all ordinary methods of treatment. After five injections the ulceration had completely healed.

Case 31 was a phagedenic sore of the prepuce accompanied by a macular syphilide. Two injections were given in the course of a week, at the end of which period the patient left the hospital with the sore healed, but with the syphilide still present.

Case 38 was a digital chancre of three months' duration, together with a general papulo-squamous syphilide and condylomata ani. All the symptoms cleared up after eight injections.

Case 47 was one of malignant syphilis; an indurated sore contracted five months previously was followed by rupial ulcers of scalp and limbs, and superficial glossitis. After twenty-eight injections all symptoms had disappeared, the rupial ulcers taking only a fortnight in healing.

Case 57 was a patient who had contracted syphilis in India, and who was suffering from a tubercular syphilide of the arms, destructive ulceration of the alae of the nose, ulceration of forehead, and who, moreover, had been under treatment since the contraction of the disease. After thirty injections his symptoms had almost disappeared, but his improvement was slow, as was only to be expected considering that syphilis contracted in the tropics is usually a most intractable disease.

The advantages of intravenous injections may be summarised as follows: They are absolutely painless, in which respect they are in direct contrast with intramuscular injections; the functions of the digestive tract are not interfered with; the doses of the mercurial salt are small, are certain of absorption, and can be easily regulated to the varying susceptibilities of different individuals; with ordinary precautions the treatment is perfectly safe, and, even if the vein is missed, little or no inconvenience is caused thereby; the resulting improvement is certain and rapid, and consequently it would seem to be indicated in cases of cerebral syphilis; my experience does not warrant me in offering an opinion as to whether this treatment is followed by relapses, but so far I have not met with any. The only real objection I can see to the method is the difficulty experienced in some instances of bringing the veins into sufficient prominence, and in a certain proportion of cases, especially amongst women, this is an insuperable obstacle. In conclusion, I am of opinion that in intravenous injections we have a valuable addition to our antisiphilitic therapeutical agents, though the plan is one which obviously cannot be recommended as a routine in practice.

SAFEGUARDS IN CHLOROFORM ADMINISTRATION.

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THE capital fault in the ordinary method of giving chloroform is the absolute want of control on the part of the administrator over the quantity that the patient may inhale with each inspiration. It is common to find a great variation in the depth of the respirations taken by the patient during the time that he is going under, and whilst respiration is more or less within his own control, a number of very shallow inspirations being followed quickly by several very deep inspirations, whereby he may inhale a quantity sufficient to paralyse his respiratory centre. I believe that this is the explanation of most of the deaths which occur before the patient has ever

been properly under the anæsthetic. The same danger arises at another stage in the administration, namely, when the patient is threatening to return to consciousness after he has been anæsthetised. The towel saturated with vapour is quickly reapplied, and the patient, with a few deep, gasping inspirations, inhales a quantity of chloroform for which his respiratory centres are quite unprepared, and cessation of function is too often the consequence. This danger can be entirely obviated by the intelligent use of an inhaler, which accurately regulates the quantity supplied to the patient during any inspiration. I say the "intelligent use," for the same danger is present if chloroform be recklessly pumped through an inhaler as when it is given unmeasured on a towel, though to a less extent.

The secret of its safe administration lies in attention to two points:

(1) A very gradual increase in the quantity supplied to the patient whilst putting him under. If this be carefully graduated so that the quantity of vapour reaches the maximum by almost imperceptible degrees, the two disagreeable and dangerous symptoms (struggling and vomiting) are almost invariably done away with. This is attained by attending to the amount of compression given to the bulb. At the start, during several respirations, only the slightest compression is used. A slightly deeper compression of the bulb is made for several ensuing respirations, and so on until a full compression is reached, which is kept up till the reflexes are abolished.

(2) Once the patient is under, the amount must be reduced to the minimum, or something approaching it, and by continuing to supply him constantly with this minimum dose complete anæsthesia may be maintained continuously for hours with perfect safety.

The regulating inhaler made by Krohne and Sesemann meets every requirement. I may remark, however, that the feather which is supposed to guide the administrator as to the continuance of respiration is an unnecessary part of the apparatus, as the anæsthetist should have eyes for nothing but the movements of the chest wall itself. I have used this apparatus over 150 times during the past two years, and on no single occasion has the condition of the patient given rise to any alarm.

There is a great difference in the quantity of chloroform used by this method and that required when the ordinary means of administration on a towel is employed. With the inhaler the amount is from one-half to one-quarter that required when other methods are used. There is an almost uniform absence of the unpleasant symptoms of struggling and vomiting. [From a table with which Mr. Arnold has furnished us it appears that of twenty consecutive cases struggling occurred in one only—a confirmed alcoholic—and vomiting in one.] The time occupied in putting the patient under varied from a minute or two up to ten, fifteen, or twenty minutes.

The struggling in alcoholics is not that of asphyxia, but appears to be due to an action on the higher centres in some way altered by continual soaking in alcohol, and so rendered peculiarly susceptible to the excitant properties of chloroform which normally should not be evident. It betrays the fact of alcoholism at some period of the patient's history, and is almost pathognomonic.

ON AUSCULTATION OF THE HEART DURING CHLOROFORM NARCOSIS.

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THE present communication is a brief discussion of 200 cases of chloroform administration in which I have auscultated the heart. An ordinary binaural stethoscope, sufficiently lengthened by india-rubber tubing, was at first employed, but after some time I adopted the phonendoscope, connecting it, however, with the upper half of a binaural, and having a watch fitted in.

In a few cases the heart was auscultated in bed, either on the morning of the operation or the previous day, and it was found that a considerable acceleration of its action sometimes

occurred, while in one case coupled beats developed, when the patient was afterwards placed on the operating table. The further investigation may be divided into the following stages:

1. The effect of the continuous inhalation of chloroform on the heart, as determined by the rate and character of its action before and during the process.
2. The effect on the heart ensuing when the inhalation was stopped or interrupted at any time.
3. The effect of retching and vomiting on the heart, as determined by a comparison of its action before and after these events.

Speaking generally of the entire results, it may be said that nearly every irregularity or variation in the action of the heart described in clinical textbooks may come under observation during chloroform narcosis. The most marked changes have their starting point either (1) at the beginning of inhalation, or (2) soon after the inhalation is stopped, or (3) within a minute after retching or vomiting. The effects which may be observed at either of these three periods are in some respects alike, and generally consist of acceleration, irregularity, or retardation of the heart's action. The first of these is most commonly the primary occurrence, and the other two secondary, but this is not always so.

The commencement of inhalation may be signalled by a very sudden increase in the frequency of the heart's action on the one hand, or the equally rapid supervention of irregularity on the other, and it may suffice to cite two cases to show this.

The first was that of a man, aged 29 years, in whom the rate of the heart, which beforehand was 68 and regular, was doubled in frequency the moment the chloroform was applied, 33 being counted in the first quarter of a minute, that is, a rate of 132 a minute.

The other was that of a female, aged 40 years, in whom the heart's rate beforehand in bed was 108, the sounds very loud, especially the first; afterwards on the table 132, sounds very loud, and so alike in character that I was uncertain which was first and which second. Chloroform being commenced, almost at once there was irregularity, tumultuous action ushering in coupled beats¹ in half a minute, which were of curious rhythm at first, but soon assumed the ordinary form. At this time I tried the pulse, but it was weak, and I could not count it. At the third minute, the heart's action became quite regular, 112, and remained so till anæsthesia was complete (six minutes altogether), when it was 60.

The last case was a type of what generally happened when the chloroform was steadily continued, acceleration or irregularity giving place to slow and regular action in deep anæsthesia; and this was even observed in some cases where the heart was irregular on the table before the inhalation was commenced.

Seven cases of apnoea, or that temporary stoppage of the respiration occasionally seen early in the administration, were observed, the pause in the breathing varying from ten to thirty seconds. It was only in the case of the briefest stoppage that any alarm arose, or that artificial respiration was resorted to for a few seconds. Now, we read in some fatal cases that the breathing stopped in the course of the first minute or two, and that the chloroformist desisted and performed artificial respiration. Here I must record the opinion, which I have long entertained, that any such stoppage is a mere pause, and that to stop the administration and have recourse to artificial respiration are both alike wrong—are, in fact, a double blunder which must be held accountable for all the disasters that have followed.

The most important question is that with which we have now to deal, namely, the effects which may ensue when the inhalation is stopped. The first result is that the vapour in the lungs is expelled in a few seconds with the first two or three expirations, although this period may be longer when the breathing is slow and shallow. It follows that any effect

¹ On the subject of coupled beats see Sir William Broadbent *On the Pulse*, pp. 107-123, where it is stated that the only drug known to cause them is digitalis. The inhalation of chloroform, and probably of other poisonous gases, must be added, while they are also to be seen on some of the blood-pressure tracings of Liver and Schäfer, illustrating the effects of intravenous injection of suprarenal extract. (*Journal of Physiology*, vol. xviii, p. 242.)