Absorption technique, cyclopropane, curare, should not be taught.

I must apologise for only having touched upon a few salient points of this subject, but have purposely cut the address short in order to allow time for our guests and members to give us the benefit of their views on this subject.

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INTRAVENOUS ANÆSTHESIA, PAST AND PRESENT

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ALTHOUGH the first successful intravenous anaesthesia in man dates as far back as 1872, this form of anaesthesia has received many setbacks since its inception. Its early development was retarded by lack of suitable agents. The introduction of derivatives of barbituric acid has played an important part in popularizing, and in giving, intravenous anaesthesia a justifiable place.

It is difficult for us to realize that until approximately ten years ago this form of anaesthesia was the exception, rather than the rule.

Historical

We all know that Dr. Crawford Long in 1842, and Dr. Wm. T. G. Morton in 1846, administered ether by inhalation to produce general anaesthesia. It was not until thirty years later that the first drug was injected intravenously, namely chloral hydrate, by Oré of Lyons, France, in 1872.

One can understand that, with the uncertainty of general anaesthetic agents as then known, any new method would be of great interest.
As far as is known the credit for the first discovery of a method of conveying liquors directly into the blood-stream may be attributed to Sir Christopher Wren, the famous architect. His experiments were carried out in the house of the French Ambassador, the Duc de Bordeaux, in 1656. Wren was at that time Professor of Astronomy at Oxford. He ligated the veins of a large lean dog, made an opening in the vein on the side of the ligature nearest the heart, and injected opium by means of an animal bladder, to which a quill was attached.

He found that this stupified, but did not kill the animal. On the other hand when he injected a dose of crocus metallorum the dog started to vomit and died. He was, however, unaware of the anaesthetic results of the injection of opium.

Probably the first genuine attempt (as suggested by Jarman) to produce intravenous anaesthesia was made in 1665, when Sigismund Elsholtz injected an opiate to produce unconsciousness.

In 1654, Francesco Folli of Florence reported the successful transfusion of blood to animals, and this was repeated by Daniel of Leipzig in 1664.

At about this time (February 1665) Richard Lower transfused blood to animals for the first known time.

On June 15th, Jean-Baptiste Denys of France, with the help of a Dr. Emmerez, first transfused blood to man. Dr. Lower’s results were published in the Philosophical Transactions of the Royal Society for December 17th, 1666, and Dr. Denys’ experiment was published in the same Transactions on July 22nd, 1667.

Lamb’s blood was used in most cases, but in some of Denys’ cases he used the blood of calves. So severe were the reactions in some cases, leading to death in one patient at least, that blood transfusions were abandoned, unfortunately, for many years.

Thus the injection of fluids was a much older procedure than the injection of anaesthetic agents.

The first record we have of any method concerned with the
venous system was that introduced by the ancient Assyrians, who compressed the veins of the neck, and probably the carotid arteries as well, to produce a temporary unconsciousness prior to the operation of circumcision.

James Blundell, a distinguished English obstetrician and physiologist, reopened the subject of transfusion of blood. Many of his patients had died from puerperal and post-partum haemorrhage. He felt that these might have been saved if they had had transfusions of blood. He postulated that the blood should come from an animal of the same species.

He was the first to transfuse human blood to a patient. According to Sturgis, out of ten patients thus transfused five died and five recovered.

In 1831, Latta of Leith, in Scotland, introduced the practice of intravenous saline solutions in cases of severe collapse.

The introduction of the hypodermic syringe in 1845, by F. Rynd of Edinburgh, and the hypodermic needle (credited by most authors to Alexander Wood) was another milestone in the development of the technique.

Chloral hydrate as used by Ore was not well suited for anaesthesia, so in 1899, Dreser of Munich introduced hedonal; and in 1905, Krawkow and his co-workers at St. Petersburg demonstrated its value for anaesthetic purposes.

Fedorow of St. Petersburg reported on 530 cases, in which he used hedonal as an anaesthetic agent in a physiological solution of sodium chloride.

The first volatile anaesthetics used intravenously were chloroform and ether, by Burkhardt in 1909. It need scarcely be added that the former did not prove satisfactory, and the latter found little favour.

In the same year Bier used the regional intravenous method of obtaining anaesthesia of the limbs. He injected a solution of procaine hydrochloride into the veins near the site of the proposed operation.

In 1912, J. Goyanes of Madrid reported on the intra-arterial use of procaine hydrochloride.
Paraldehyde was used by Noel and Souttar in 1913, but its use intravenously was limited.

Peck and Meltzer reported upon the use of intravenous magnesium sulphate, but only a few cases were recorded, and its use seems to have been soon abandoned.

Morphine and scopolamine were used about the same time by Bredenfeld, and since then the intravenous injection of morphine has been found most useful, for purposes other than anaesthesia.

Ethyl alcohol was first used intravenously, in 1921, by Naragawa of Japan. For the next ten years numerous experiments were made with this agent.

Intravenous ether was again reported upon in 1913, but this time in combination with isopral. Separate containers were used for each agent. These were connected to the same cannula. The isopral was administered first, and was infused until anaesthesia began to appear. The injection of isopral was then discontinued and the anaesthesia maintained with ether.

The first barbiturate to be synthesized was barbital or veronal, by Emil Fischer and von Mering in 1903. The first to be used as an intravenous anaesthetic was somnifaine. It was a long-acting drug, very slow in producing anaesthesia, and, as a result, it left patients in a deep sleep, which lasted from 24 to 48 hours. Others in this group were phenobarbital, soneryl, dial, and neonal.

Daniel and Gabriel Bardet published a paper on somnifaine, in 1920, describing its anesthetic properties, and Ferdet and Perlis introduced the intravenous technique of administering the drug. They gave their patients a preliminary subcutaneous injection of morphine and scopolamine before injecting the somnifaine. The patients slept for a considerable time, and when roused, complained of severe headache and drowsiness.

In the same year dial was used.

Pernoston or pernocton was the first barbiturate to be used widely for general intravenous anaesthesia, and was very popular in Germany.
In 1929, Zerfas and McCallum, and others, reported upon the use of sodium amytal intravenously, as did Lundy. In the United States of America this drug was used extensively from 1929 to 1933. It is still used regularly for the treatment of mental patients.

The intravenous use of pentobarbital sodium (nembutal) was reported by Fitch, Waters, and Tatum, in 1930.

The first real step in progress was made when evipan was discovered. It was first synthesized by the chemists Kropp and Taub, and a report on its pharmacological and clinical effects made by Weese and Scharpf.

It combined two valuable properties from an anaesthetic point of view: rapidity of action and shortness of anaesthetic effect, One of the earliest papers on the drug was published by Jarman and Abel in 1933.

In 1934, Lundy introduced the technique of intermittent intravenous administration of pentothal sodium. It was found to be far more potent than evipan, and gave better relaxation. So far this is undoubtedly the best agent we have for the production of general anaesthesia by intravenous injection. The drug is potent, acts promptly, is rapidly detoxicated and eliminated, and has few deleterious side actions. For this reason I wish to confine my subsequent remarks to the action and uses of pentothal sodium.

**The Chemistry of Pentothal Sodium.**

Pentothal sodium (syn. sodium thio pentobarbital) is sodium ethyl (1-methylbutyl) thiobarbiturate. It is an amorphous powder, light yellow in colour, with a distinctly sulphurous odour. Readily soluble in water and alcohol, forming a strongly alkaline solution. The powder is somewhat hydroscopic. To prevent hydrolysis, with the separation of the free acid, a buffer, in the form of sodium carbonate, is added to the commercial preparation. The pH of a 2.5 per cent solution is between 10.4 and 10.6. It dissolves readily in water, forming a light yellow, clear and translucent solution.
It is supplied in ampoules of 0.5 to 1.0 gm., the only addition to the salt being 6 per cent by weight of carbonate of sodium, to give stability.

A solution mixed in a syringe and left, if not exposed to the air, will last for one or two days, or even longer. If there is any sign of opacity or any visible foreign matter, the solution should be discarded. The pentothal sodium should be dissolved in triple distilled, chemically pure water only. It is not a bad technique to wash the syringe used with 1 cc. of the distilled water before mixing the whole of the solution.

Numerous dilutions have been used. In this country we favour a 5 per cent solution, but in America they prefer a 2.5 per cent solution.

Much work has been done to determine the toxicity, potency, and effects on the various organs, but there is still much to be settled. We know, however, that it causes varying degrees of hypnosis, sedation, analgesia, anaesthesia, and respiratory depression, depending on the dose employed, and the method of administration.

The effect is produced rapidly, and, provided only one dose is administered, wears off rapidly. The patient recovers without any after effects.

Respiratory System

Depression of respiration is its foremost effect, the degree depending on the amount administered, and the rate of injection. Complete arrest may occur, but as the heart continues to beat one is able to maintain life until the depression of respiration has been overcome.

It is of interest to note that if a lethal dose in animals is injected rapidly then the heart will cease to beat soon after the respirations have failed.

The part played by respiratory stimulants, in cases of overdose, is of interest. The administration of oxygen and carbon dioxide, together with artificial respiration, forms the most effective measure. It would appear that in such cases the
injection of drugs such as coramine, metrazol, picrotoxin, etc., is of doubtful value.

So long as the circulation is maintained adequately by artificially ventilating the lungs, to give the body time to overcome the overdose, respiration will be established spontaneously.

Adequate pulmonary ventilation, as well as a good colour of the blood, is very important to prevent carbon dioxide accumulating in the tissues, and the use of carbon dioxide as a respiratory stimulant is contra-indicated unless artificial respiration is being given.

The beneficial effects of giving oxygen during pentothal anaesthesia are apparent, especially if cyanosis is present.

So far as the heart muscle is concerned, it has been shown by the Cushny myocardiograph that there is a marked decrease in the force of the contractions of the auricles and ventricles, with a simultaneous dilatation or increase in the volume of the heart, leading to weakened force of contraction.

Effects

Unconsciousness is produced rapidly and pleasantly. After a period of quiet, the patient passes into a state of anaesthesia, without any evidence of excitement. Muscular relaxation is variable, but as a rule, so well marked in the neighbourhood of the jaw as to require somebody at hand to support it. Unlike evipan, muscular twitchings are rarely seen.

The degree to which blood-pressure falls depends largely upon the rate of injection of the solution. If the injection is rapid the fall in blood-pressure is pronounced. As a rule recovery takes place after a short interval. Respiration is depressed, the amplitude being affected more than the rate. Here again the rate of injection has a marked effect upon the degree of depression. If slow, the respirations may not cease at all.

If fairly rapid, after the injection of from 5 to 6 cc. of the
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5 per cent solution, respiration ceases. After a pause of from thirty to forty-five seconds it spontaneously begins once more.

If very rapid, respiration will cease, and may remain without any attempt at recovery for some five to ten minutes, during which time the patient will require aided respiration to maintain life.

Even if one continues to inject pentothal slowly, whilst there is no evidence of respiration, without a safety pause, after from 12 to 14 cc. have been given spontaneous respiration can occur.

Luckily the sequence is fairly regular for each individual. Inject say 6 cc. rapidly. The respirations become very pronounced for a very short period. They then cease altogether. After a pause they slowly return. If the injection is then continued at a fairly rapid rate, immediately before the patient is becoming deeply anaesthetized the amplitude of respiration again becomes pronounced, before ceasing for a second time.

Thus we have, as in other forms of anaesthesia, a very sure guide to the depth of anaesthesia by watching the respiration.

The pulse rate is accelerated at least four to ten beats per minute.

The colour remains good as a rule, but in certain types of patient, blueness becomes fairly well developed. In such cases it is a wise precaution to give continuous oxygen at the same time as the injection is being made.

The eyes are not very reliable as a sign of anaesthesia. At first the pupils may dilate a little, but later they become smaller than normal, central and fixed.

Very occasionally tremors are observed, and if given too quickly, hiccough may develop, which is usually cured by giving a little carbon dioxide.

Laryngeal spasm may occur in the early stages of anaesthesia. In my experience it is usually due to too light anaesthesia, and is rarely seen if an adequate dosage is given. One of the best ways to produce it is to be too eager to insert an airway as soon
as the jaw relaxes, or again, if the surgeon begins to operate before the patient has had time to settle down.

The stages of anaesthesia are well defined to one accustomed to this method.

(1) Light narcosis. During this period the outstanding feature is a feeling of inebriation, visibly expressed by a drunken grin, loss of fear, a delayed cerebration, followed by yawning and unconsciousness. Occasionally a complaint is made of a taste of sulphur at the back of the throat.

(2) “Stage of inebriation.” Response to pain still present, but not to lesser stimuli. At this stage the knee jerks are exaggerated.

(3) Anaesthesia. No response to painful stimuli. The blood-pressure may fall as low as 80–90 mm. Hg. Respiration is shallow; the tongue falls back; the corneal reflex is abolished; the pupils contracted and fixed; superficial and deep reflexes diminished or absent; the rectal sphincter may be partially relaxed.

(4) “Pre-mortem stage.” All reflexes seriously depressed or absent. The blood-pressure is at shock level.

Recovery is quiet, but occasionally the patient is irrational, noisy, and hyperactive, needing restraint and supervision until this stage is passed.

**Equipment**

A 20 cc. syringe with an eccentric nozzle, and needle size 14, with a short bevel, for intermittent doses.

For continuous anaesthesia the apparatus designed by Jarman and Abel is excellent. The syringe has a three-way nozzle. In the central position the syringe communicates directly with the vein. Turned to the left, the position can be used for intravenous glucose saline. To the right the syringe communicates with the pentothal solution.

**Selection of cases and premedication**

This depends on whether the patient is an out-patient or an in-patient. In the former case atropine can be given with
advantage, omitting the morphine. In the latter the best form of premedication is the hypodermic injection of morphine gr. 1/6 and atropine gr. 1/100 at least one hour before operation. The atropine is especially useful in preventing the tendency to laryngeal spasm, especially if a supplementary anaesthetic, such as ether, is used; whilst the morphine will diminish the amount of pentothal required.

The stomach should be empty and no solid food given for at least four hours before operation. The bowels should have the routine preparation and to prevent over-distension the bladder should be emptied before the injection is made.

Administration

Where possible I use the crucifix position. A board, with a piece cut out of the width of the operating table, so as to lessen the thickness under the patient, is placed in position under the shoulders. Each arm is then lightly fixed in the extended position. One is thus able to use either arm for the intravenous anesthesia or for blood-pressure recordings, without disturbing the surgeon or his assistant.

The pentothal and ampoule of chemically pure sterile distilled water should be placed in a bowl of spirit. Near at hand, in case of emergency, a bottle of picrotoxin containing 20 cc. (0.3 per cent solution), and coramine in 5 cc. ampoules. An apparatus for inflating the lungs, if necessary, such as McKesson or modified Boyles apparatus.

Also some form of suction apparatus.

There are three recognized methods of injection.

1. The single dose method.
2. The intermittent dose method.
3. The continuous dose method.

Of these the first two are eminently suitable for general use. I personally recommend that the technique used should depend entirely upon the experience of the administrator. Thus in the case of students or beginners the following technique is taught.
(a) The injection of the first 4 or 6 cc. is made slowly.

(b) A pause should be made at the end of the injection to watch the effect on respiration. (The so-called safety pause.)

(c) Some anaesthetists like the patient to count during this period, and stop the injection as soon as they stop counting. An equal amount to that already given is then injected, as soon as the respirations are visible.

Personally I teach the student to watch the respirations, to wait for the depression or cessation of respiration, and then to stop injecting until they become visible again; then to inject an equal amount to that already given, at a fairly deliberate rate.

With added experience I make them continue the injection until the respirations become deeper, and then to stop.

For the intermittent method the needle is left in the vein, and further quantities of pentothal injected 1 cc. at a time as required.

Since the advent of curare I have abandoned the continuous method of intravenous anaesthesia, as I feel that the technique is unnecessarily complicated for the results obtained.

My present preference so far as technique is concerned is as follows:

The patient is premedicated with morphine gr. 1/6th and atropine gr. 1/100th. Induction is carried out with pentothal, 6 cc. being given rapidly. Respiration invariably ceases. A pause is made until the respiration is visible again. Pentothal is then injected until the respirations cease once more. This is usually preceded by an increase in the amplitude of the respiratory movements. The usual amount in an adult to produce this result is approximately 16 cc. of pentothal, provided the injection is fairly rapid.

Either an airway or an endotracheal tube is passed under the pentothal injection alone, but prior to this the lungs are gently inflated with oxygen.

The respiration is aided by pressure on the rebreathing-bag,
until the movements are spontaneous. The mixture given until this occurs is 33 1/3% oxygen and 66 2/3% nitrous oxide.

As soon as the patient begins to breathe spontaneously an injection of 10 mg. of curare is given.

To err on the side of safety it is my opinion that the student should be taught the following principles:

1. To select the suitable case.
2. To inject slowly and intermittently.
3. To maintain a free airway.
4. To have adequate supplies of oxygen at hand.
5. To be prepared for the relief of respiratory or cardiac failure.

What is the suitable case? The more one makes use of intravenous pentothal anaesthesia the more one feels that contraindications are few.

Amongst these I would list:
1. Cardiac disease with decompensation.
2. Hypotension.
3. Severe liver disease.
4. Severe renal disease.
5. Severe cachexia, anaemia, and dehydration.
6. Cases of dyspnea from any cause.
7. Acute or chronic obstruction of the respiratory tract, such as oedema of the glottis, Ludwig's angina, etc.

I use the word severe, because one knows by experience that if one uses discretion in the dosage, even in the above cases, pentothal can be a suitable anesthetic agent.

There are three types of case which always cause me to pause and think, and hence to be cautious.

First and foremost, cases of bronchiectasis. These always react unfavourably. They become cyanosed, and in a certain number of cases, seem to develop bronchospasm.

In the past three years I have had three patients who could easily have died, but owing to strenuous efforts, were able to survive.

Case No. 1. Advanced bronchiectasis; for bronchoscopy.
After 6 cc. pentothal the colour became livid. The appearance was corpse-like. Inflation of the lungs was attempted without success. The bronchoscope was passed, suction maintained, and oxygen under pressure insufflated. After forty-five minutes the colour returned.

Case No. 2. Similar to the previous case, except that in this case the colour returned after fifteen minutes.

Case No. 3. For teeth extractions. Receding jaw; bad chest, stated to be a chronic bronchitic. After 6 cc. pentothal, colour livid; appearance of impending death. Inflation of the lungs successful after twenty minutes. Owing to the receding jaw the laryngoscope was at first unsuccessfully applied. After twenty minutes the tube was passed and the patient coughed up pure pus. The teeth were then extracted without further trouble.

Then again the fat, thick-necked, plethoric type of patient, especially if they have a receding chin. Unless care is exercised they seem to delight in going into spasm.

Finally the case of intestinal obstruction, where a spinal is contra-indicated. Twice I have had cases in which, after a small amount of pentothal has been administered, the back of the throat became full of thin brown liquid, necessitating prompt action to prevent a catastrophe.

One such case was an old lady of 85 years of age. She was supposed to have had gastric suction for the past three hours. As soon as the pentothal was administered the trouble began. Copious fluid regurgitated. The patient was livid and almost pulseless. After a strenuous fight for twenty-five minutes, during which time the surgeon had given her up, she was intubated and had a resection of colon lasting for one hour and three-quarters. Subsequently, she had a local anaesthetic. Eventually she had to have another general, but this time all went well.

These are the type of case about which I feel there is definite danger in using pentothal as an anaesthetic agent.

Provided, however, one realizes this danger, and that one is
prepared to meet these distressing emergencies, even then, all will be well.

A word about the extremes of age. It has been stated that these are contra-indications for the use of pentothal. Personally I have no fears in using pentothal in old people. So far as young children are concerned, however, I like to restrict its use to children over the age of six. Even then I prefer to go by body-weight rather than age.

**Uses**

Pentothal anaesthesia has very definite uses. For minor procedures it gives a pleasant anaesthesia which has very little or no after effects. For example: dilatation and curettage, reduction of fractures and dislocations, incision of abscesses, in fact, for any minor operation.

Where the cautery or diathermy is used.

For an easy and pleasant induction. As we all know, in these days the patient often says, “Are you going to give me pentothal?” and then stretches out one arm.

For basal narcosis.

For a complemental anaesthetic agent.

For the relief of convulsions produced by poisoning from local anaesthetic or ether, or in the case of tetanus.

**Obstetric Practice**

Pentothal is chiefly of use in the later stages of labour, or a short while before delivery.

There does not appear to be any undue respiratory depression, or asphyxia of the baby, although there may be some impaired power of the mother to bear down.

About 7 cc. is all that is necessary for the average case when the head is on the perineum.

For Caesarean section I have used pentothal for induction in doses of 6 cc. of the 5 per cent solution, without any after effects on the child. Solomons reported on the use of pentothal sodium in forty-three obstetric cases, in which he employed total doses
of 10 to 18 cc. of a 10 per cent solution. He said that morphine, scopolamine, or pentothal sodium, can be safely administered for premedication.

**Laryngoscopy, Bronchoscopy, Endoscopy, Gastroscopy**

These examinations are not very satisfactory under pentothal sodium anesthesia. One may relax the jaw perfectly, but as soon as the surgeon attempts to pass a bronchoscope there may or may not be trouble. Especially is this the case where a diagnostic biopsy is to be made for cancer. These patients often have an embarrassing cough, and I have given 1 1/2 gm. of pentothal without eliminating this cough reflex.

I have found that to induce with 10 cc. of a 5 per cent solution, and to allow the patient to breathe gas and oxygen mixture, with a minimum of trilene will allow one to perform these procedures without much trouble.

Now, of course, we are able to make use of curare, which has altered the situation entirely.

**Disadvantages**

What are the disadvantages of pentothal anesthesia? First of all its action is not reversible. Once the drug has been injected, one has to wait until it has been detoxicated.

The reflexes are not necessarily abolished. Unfortunately the laryngeal and pharyngeal reflexes remain, and laryngeal spasm is liable to occur.

This type of anesthesia is only suitable for a limited type of operation, although for induction purposes its use can be almost universal.

The severe respiratory depression, unless one is used to dealing with such a condition, can be worrying.

Muscular relaxation is apt to be good in some cases and definitely bad in others.

An assistant is really necessary to maintain anesthesia safely.

**Complications**

The most important complications that can occur are venous
thrombosis; inflammation of the subcutaneous tissues; vomiting; jactitation; and finally, intra-arterial injection of pentothal resulting in extensive thrombosis.

**Venous Thrombosis**

I have only seen three cases of venous thrombosis. These occurred during the war. One was after the injection of a 5 per cent solution of pentothal. In this case a second injection at a later date caused no ill-effects. The second case was after the injection of a 2.5 per cent solution, and the area where the thrombosis occurred was at a situation remote from the site of injection. The third occurred in a dental surgeon who was being operated upon for a simple whitlow. The amount of pentothal used was small and the operation of short duration. I suspected the sterilizing of the needles.

**Inflammation of the Subcutaneous Tissues**

I am pleased to say that so far I have not seen any trouble due to this. I have, however, seen a soldier in the Middle East who had an arm in which the tissues round the forearm were scarred and contracted, following the extravenuous injection of a full dose of pentothal.

**Vomiting**

I have already referred to the regurgitation which may occur in cases of intestinal obstruction. The importance of an empty stomach is emphasized in the following case.

An officer, aged 56 years, of the, shall we say, plethoric type, fell and fractured the neck of his femur. The surgeon insisted on an immediate operation. I refused to give the anaesthetic as he had only just had his dinner. Another anaesthetist was impressed or coerced, and duly gave about 4 cc. of soluble hexobarbitone before the patient began to vomit large amounts of undigested food. He became deeply cyanosed, especially round the lobes of his ears. After rapidly cleansing his nasal passage, as well as was possible, I was fortunate enough to pass
a Magill’s tube blindly, during an attack of coughing. He made an uneventful recovery, and congratulated the anaesthetist on the best anaesthetic he had ever had.

**Jactitation**

Luckily this is very rare with pentothal. I think it is caused by too rapid injection of the drug, a deficient airway, and the injection of a solution which has only been made up immediately before injection.

**Intra-arterial Injection of Pentothal**

This is an accident which, so far, has eluded me, I am pleased to say. Macintosh and Heyworth described two cases in which this had occurred. Similar cases have been recorded by Lundy and others. Adams recorded a case in which, although it was recognized at the time, the injection was continued, without any untoward results.

The symptom which should cause it to be recognized immediately, apart from the colour of the blood in the syringe, is an agonizing pain down the arm to the fingers.

**Post-operative Care**

Entirely depends upon the amount of pentothal given. In any case the patient should always be watched until reflexes have returned or even consciousness. I know of a case which was left unattended after simple extractions of teeth. When seen later he was dead.

Even after short anaesthetics patients should not be left unattended, when apparently normal and conscious. Some patients have been known to have a period of complete amnesia, although apparently normal, and to be totally irresponsible for their actions whilst in this condition. A few may recover consciousness and then have a second period of unconsciousness. Some show excitement and marked aggressiveness. The treatment is an early dose of morphia.

For over-dosage or persistent depression of respiration
coramine in intravenous doses of 5 to 10 cc. is indicated. Picrotoxin, 2 to 3 cc. of a 0.3 per cent solution at intervals of fifteen to twenty minutes is also excellent. Not forgetting oxygen and carbon dioxide and, if necessary, the use of the McKesson or any other apparatus which is capable of giving oxygen under pressure.

**Mortality**

In skilled hands this appears to be very low. So far, I have not had any deaths due to this form of anaesthesia. Jarman claims 45,000 cases without a death.

**Conclusion**

I feel that in the past ten years, and especially during the war years, intravenous anaesthesia has proved its worth, and has established itself as a safe and reliable means of producing anaesthesia.

The advent of curare has only served to enlarge the scope of intravenous anaesthesia, and to add to the comfort of the surgeon, although it cannot be denied it has at the same time added to the responsibilities of the anaesthetist.

**REFERENCES**


**CORRIGENDA**

January 1948 issue: page 14, line 30
for "I gave 1.0 gm." read "I gave 10 mgm."