can, however, be surmised from the solubility of the substance. If a quick effect is desired a barbiturate containing sodium should be used.

Hang-over and Cumulation

The questions of hang-over and cumulation depend upon the completeness with which the drug is dealt with by excretion or detoxication over periods of eight and twenty-four hours respectively. They are best determined by therapeutic trial, but the laboratory data are of interest. Barbiturates meet with various fates after ingestion. Some are re-excreted, others are broken down, and others disappear mysteriously. Frethwurst, Halberkann, and Reiche⁶ could recover 75 per cent. of a given dose of barbitone from the urine, 65 per cent. of pernocton, only 30 per cent. of dial, between 10 and 40 per cent. of luminal, and no amytal or neonal at all. Evipan is said to be metabolized completely in a few hours. Clearly urine analysis alone does not yield any reliable index of the probability of hang-over. Cumulation is more easily determined, especially if the drug is recoverable in part from the urine. Barbitone is known to be a serious offender, and the following analyses^{8, 9} furnish the chemical explanation of the defect: only 8 per cent. appears in the urine in the first twelve hours; 20 per cent. in the first twenty-four; 36 per cent. in the first forty-eight; and traces can be found for as long as nine days after a single dose.

A number of other important points are only decided after the drug has come into wide use and experience has accumulated. Toxic effects may arise, due not so much to the cumulation of the drug in the tissues as to the summation of its effect on the tissues. Mental impairment and the motor paralysis following luminal are examples of this kind of trouble. The range of possible idiosyncrasies and the degree to which the patient is exposed to the risks of addiction are only discernible after the drug has been in use for years.

TABLE V.—Some Hypnotic Mixtures

Alepsal	= Phenobarbital, belladonna, and caffeine
Beatol	= Barbitone, valerian, and hyoscyamus
Belladenal	= Phenobarbital and the alkaloids of belladonna
Bromidia	= Chloral bromide and hyoscyamus
Bromovalerianate	= Chloral bromides and valerian
Brosedan	= Bromide and yeast
Indonal	= Barbitone and cannabis indica
Neurinase	= Soluble barbitone and valerian
Theogardenal	= Butobarbital and theobromine
Veronidia	= Soluble barbitone and passion flower

PRACTICAL SUGGESTIONS

1. The rejection for general use of any proprietary preparation which is merely a mixture of old familiar friends. It may be appropriate when circumstances are exceptional.

2. The rejection of any proprietary preparation exploiting the pain-relieving properties of amidopyrine and other coal-tar analgesics. These parent substances can be prescribed from the B.P., with the addition, if desirable, of the hypnotic of individual choice. Similar rules could be formulated on a rational basis in all branches of this subject of the proprietaries. If universally adopted they would spare the memory a great and daily increasing burden.

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BASAL ANAESTHETICS AND ALLIED SUBSTANCES

THEIR USE AND MISUSE *

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The group of anaesthetic agents to which a great deal of attention has been drawn in the last few years are solids which are administered to the patient in solution in water. They provide a contrast to the well-known anaesthetic gases which are absorbed through the lungs. In this paper the attempt is made to discuss this group of non-inhalational narcotics, many of which, in view of the incomplete nature of the anaesthesia they produce when given in safe doses, have been termed "basal anaesthetics."

Although a great deal has been written on the subject by manufacturers, anaesthetists in this country have not yet offered discriminating criticism to any large extent. The medical profession and the public owe much of the progress of therapeutics in modern times to the research departments of the great drug and chemical manufacturers; but it is very necessary that judgement on the relative values of the products which these important firms offer should be dispassionate in order that, in a particular condition, the most suitable drug may be selected. To read a short excerpt quoted in the reports of a drug firm without the whole context often leads to misunderstanding of the meaning of the original author.

CHEMISTRY OF THE BARBITURATES

The substances known as sodium amytal, nembutal, pernocton, hebaral, sodium soneryl, and sodium evipan all belong to the large new group of barbiturates which modern research has elaborated. The pioneer work in basal anaesthesia by Zervas of Indianapolis with sodium amytal and by Lundy of the Mayo Clinic with sodium amytal and nembutal (which Lundy originally called embutal) should be recalled. In 1930 the present writer, together with Dr. Magill, Dr. Apperly, and Dr. Parsons, witnessed some of the work in American and Canadian clinics, and subsequently the possibilities of the various methods which are available in this interesting branch of anaesthetics have been explored by many anaesthetists in this country.

The chemistry of the barbiturates is important but somewhat obscure. For help in the compilation of the brief but by no means complete account which follows I have to thank Dr. Nierenstein of Bristol and Mr. Garfield Thomas of the Birmingham General Hospital.

About thirty years ago it was pointed out by Nebenthaue that if one prepared an isomer of urea a drug could be prepared which produced hypnotic qualities. Now urea $\text{NH}_2\text{—CO—NH}_2$ has the linkage —NH—CO— , which can be tautomerized to —N=C(OH)— . The position, however, becomes more complicated in the case of barbituric acid. Here the system $\text{—NH—CO—CH}_2\text{—}$ may tautomerize to $\text{—N=C(OH)—CH}_2\text{—}$, and thus produce a substance possessing hypnotic properties, or —NH—C(OH)=CH— may be formed, which would thus exclude the production of an hypnotic. This actually takes place in barbituric acid, which has no hypnotic properties. This tautomeric form —N=C(OH)— is termed "the Nebenthaue factor." In order to render the new linkage a stable compound, various groups such as ethyl groups replace the mobile hydrogen atoms. This opened up a new era for the

* Delivered to the Midland Medical Society, January 10th, 1934.

drug manufacturers, and a variety of hypnotic drugs were prepared with names which differed according to the nature of the immobile radicles—veronal, allonal, neonal, luminal, etc.

Now in more recent years we have become aware that, for some reason, substances which contain an asymmetric carbon atom (and which are optically active), possess very powerful physiological effects in the body (for example, the carbohydrates, the proteins, the alkaloids, and adrenaline). The effort was then made to prepare a derivative of the barbiturates which contained both the Nebenthou factor and, in the affixed radicles, an asymmetric carbon atom. These substances, of which nembutal (sodium ethyl (1-methylbutyl) barbiturate) is a well-known example, are employed in the form of the sodium salts which are soluble in water, with the result that they can be readily absorbed from the intestine. The presence of an asymmetric carbon atom suggests the possibility that the strength of specimens may vary according to the proportions of dextrorotatory and laevorotatory moieties which are present. Mr. Garfield Thomas, however, upon examining a few specimens of nembutal, has not found the optical activity to vary greatly. This point may be worthy of further attention.

In addition to the influence of (1) the Nebenthou factor and (2) the asymmetric carbon atom, the hypnotic power of the barbiturates also varies considerably with (3) the complexity and composition of the side-chains, and other affixed radicles.

THE NEWER COMPOUNDS AND THEIR EFFECTS

The duration of their effects differs, and the differences depend partly on the rate of excretion of the unaltered drug and partly on the rate of destruction of the drug in the body. Barbituric acid itself is inert, and therefore the drugs are rendered inert by the oxidation of their side-chains, so that the drugs with the least stable side-chains produce the shortest actions. Luminal is oxidized but slowly, it is slow-acting, and it is of great value in epilepsy. Sodium amytal and nembutal are short-acting. Sodium evipan is oxidized the most rapidly of all.

The drugs are removed from the body by oxidation and detoxication (principally in the liver) and elimination through the kidneys. In the case of sodium evipan, apparently, these processes occur with such rapidity that the effects of an overdose soon pass off provided that respiration and circulation can be prevented from failing completely.

A number of these compounds have been prepared, and it may perhaps be remarked that the researches into their action in animals and in human beings have proved to be more fruitful in those countries which possess ample opportunities for animal experimentation, such as Germany and America.

The best known of the newer barbiturates are: sodium iso-amyl-ethyl barbiturate (sodium amytal), sodium ethyl (1-methylbutyl) barbiturate (nembutal), butyl-*b*-bromallyl barbituric acid (pernocton), and sodium *n*-methyl-*C*-C-cyclophenyl-methyl barbiturate (sodium evipan). Pernocton possesses a bromine atom, and it is therefore

more than a simple barbiturate. Sodium soneryl, hebaral, and somnifene are members of the same group which are employed by many workers. They do not all possess an asymmetric carbon atom.

Lundy has pointed out that for practical purposes he divides the effects into three stages: Stage I (*hypnosis*): The patient can be roused to speak and even to voice his disapproval if pinched, but subsequently he has little or no memory of the incident. Stage II (*inebriation*): He moves when the skin is stimulated, and may be restless, but he shows no signs of consciousness. Local anaesthesia is not in all cases aided by this stage, because the restlessness may cause an operative procedure to be well-nigh impossible. Stage III (*anaesthesia*): There is no response to painful stimuli, but often in this stage respiratory depression, a fall in blood pressure, and a tendency for the tongue to fall back are observed. Shock, and pulmonary oedema leading to broncho-pneumonia, may result from a particularly large dose of the barbiturate.

One may sum up the situation by saying that the first stage—hypnosis—is generally achieved with administration by the mouth; inebriation—that is to say, complete unconsciousness—with administration by intravenous injection; the third stage—narcosis—is not generally regarded as desirable in the case of sodium amytal, nembutal, and pernocton, but the new drug known as sodium evipan is said to be relatively safe as a true narcotic. Thus, in dogs, the minimal dose of sodium evipan is said to be more than five times the minimal narcotic dose.

ADMINISTRATION

In administration of the barbiturates the oral and intravenous routes are generally found to be the more useful. Intramuscular injection and instillation of a barbiturate solution into the large bowel have also been employed. I have not had much experience of the intramuscular route. In my hands the onset of hypnosis is delayed, a relatively large dose is required to obtain sleep, and one is chary of employing the method because one does not dare to give an adequate dose from the fear that when at last the whole of the solution has entered the circulation and the full effects have developed, the patient may suffer from an overdose. I have not employed the rectal method in many cases. It is not particularly convenient, and the correct dosage is not easily determined.

Avertin (tribromethyl alcohol, CCBr3) is well known. I would remind you that the solid avertin is supplied in solution in amylene hydrate (1 gram in 1 c.cm. of solution), that it is sparingly soluble in water, so that the watery solution which is instilled into the patient is of large bulk, and that the rectal route is almost universally employed. When given intravenously avertin is detoxicated by the liver so rapidly that consciousness returns only a few minutes after the administration has been completed. The rectal method offers slow, steady absorption, and when 0.1 gram of avertin has been given for each kilogram of body weight, the patient remains unconscious usually for a period of two to three hours. Shipway, in a personal communication based upon more than 12,000 cases, expresses his entire satisfaction with rectal avertin. Wesley Bourne of Montreal has administered avertin to one patient on twenty-two occasions within a period of ten weeks without injury to the liver or any other untoward effect.

A CONTRAST WITH GASEOUS ANAESTHETICS

Perhaps the most noteworthy point to be emphasized is the striking contrast between the gaseous anaesthetics and these solid narcotics in absorption, in action, and

in excretion. On the one hand, gaseous anaesthetics are absorbed by the lungs, the amount in the body at any particular time can be controlled with remarkable precision (particularly in the case of nitrous oxide, ethylene, acetylene, etc.), and they are excreted by the lungs without detectable alteration in their chemical composition. (It may be that chloroform and ethyl chloride are to some extent destroyed by the liver.) The principal disadvantages of the gaseous group are, first, the dislike some patients have of going through the ordeal of induction, and, secondly, the strain which is thrown upon the pulmonary tissues.

On the other hand, the problems of absorption, action, and elimination of the solid narcotics are much more complicated. Absorption depends upon the method of administration, and although these drugs are greatly appreciated by most patients, the effective dose is difficult to control. The action of the drug so long as its composition is unchanged is probably constant, but the processes of detoxication and elimination begin immediately the drug appears in the circulation.

Therefore the duration and depth of narcosis depends upon the nature of the drug, the dose, the type and temperament of the patient, the state of the heart and circulation, and the efficiency of the liver and of the kidneys. With general anaesthetics most of these problems can be dealt with as anaesthesia proceeds, for the dose is controlled from minute to minute, but all the points should be taken into consideration most carefully beforehand when administering an effective dose of a solid narcotic. After a solid narcotic has been injected, reduction of the effect of the drug is beyond the power of the administrator. Certain measures, however, are very helpful. The circulation and respiration may be improved by inhalations of carbon dioxide and oxygen combined with injections of coramine, and adrenaline or ephedrine. For the pulmonary oedema, which may occur when injecting a large dose of a barbiturate, intravenous injections of hypertonic saline with glucose, together with atropine, are recommended. It is claimed that the effects of avertin may be greatly reduced by the injection of coramine. Some think that avertin is antagonistic to iodothyrene, and that avertin is therefore specially safe in exophthalmic goitre.

THE PATIENT AND PRE-OPERATIVE SEDATIVES

I now propose to review a number of the points which have to be borne in mind if these useful drugs are to be employed to their best advantage, and they will be considered from the point of view of the patient, of the surgeon, and of the anaesthetist. The great demand by patients for the use of basal narcotics is sufficient evidence that, from the patient's point of view, the quiet and comfortable induction of sleep which these drugs offer supplies a long-felt want. Although in particular cases there may be clear reasons for withholding pre-operative sedatives, nevertheless we must accept the fact that these drugs (improved upon, no doubt, as research progresses) must be included in the armamentarium of modern anaesthetists.

We all know that it is comparatively easy with a small dose of anaesthetic to induce and maintain anaesthesia in patients who possess a calm and philosophical outlook, and also in those who are quietened by severe illness and a long period in bed. But the excitable, apprehensive, vigorous individual often requires a large dose of anaesthetic and careful handling. The alcoholic is especially difficult. In these cases the barbiturates are often most helpful and comparatively safe. For alcoholics avertin gives excellent results, and the lungs (which are frequently in a poor condition) are spared the assault of a concentrated vapour.

Oral nembital does not always answer very well if the patient is excitable, and particularly if he is aware of the nature of the drug which he is swallowing. In such a case the pylorus may be firmly closed, the barbiturate may be retained in the stomach, and the hydrochloric acid of the gastric juice may then react with the sodium of the barbiturate, with the result that the insoluble barbiturate is deposited. It is then absorbed very slowly or not at all. A small dose of omnopon beforehand and darkening of the bedroom will, in such cases, prepare the patient for rapid absorption of the barbiturate.

For the later cases in a long operation list, an early dose of oral nembital is a kindly help with which to dull apprehension. Attention should be drawn to the value of a dose of nembital on the night before operation. The rectal injection of avertin is a reliable aid for most patients, but as a routine measure it adds to the responsibilities and to the amount of work entailed for the operating and nursing staff. For patients who require repeated minor operations, and particularly for children, oral nembital is a great boon. To obtain good results in children the following suggestions may be helpful. (1) The dose of nembital by the mouth should be small (1 grain or less for a child 4 years old). (2) It is advisable, when possible, to give the sedative at night, when the child is tired. He will then fall asleep in his bed, and general anaesthesia can be induced without waking him. (3) Capsules often are refused, but the powder may be dissolved in a teaspoonful of syrup or in a strong solution of cane sugar in warm water. The extremely bitter taste of the barbiturate is thus masked. (4) If the barbiturate is not effective or if it is vomited a very small dose of avertin—for example, 0.05 gram per kilogram—may be given by the rectum. These methods enable us to anaesthetize small children repeatedly without their being aware that they have been operated upon at all. Experience has proved their value for such procedures as the setting of fractures, repeated lavage of nasal sinuses, and multiple operations for cellulitis or pyaemia.

In cases following anaesthetics in which a full dose of oral nembital has been used there is sometimes a long period of partial or complete loss of memory. A powerfully built doctor dropped off to sleep before a double hernia operation as the result of swallowing 6 grains of nembital. He did not regain complete wide-awake consciousness until two days had elapsed. This was quite satisfactory for him, because he was spared much unpleasantness, but it increased the strain on his attendants.

From the patient's point of view there is the additional advantage that in healthy subjects the frequency of post-anaesthetic vomiting is reduced by employing any basal narcotic. Vomiting, due to liver weakness, intestinal obstruction, or other causes may be increased.

THE SURGEON AND BASAL ANAESTHETICS

From the surgical point of view uniformly good results can be obtained only by employing a suitable drug with appropriate technique. For operations on the stomach barbiturates should be given intravenously, but a fall in blood pressure is often caused, and rectal avertin produces less disturbance. In American clinics intravenous nembital followed by ethylene-oxygen-ether or gas-oxygen-ether has yielded excellent results. For operations on the appendix and large bowel there are reasons why the rectal administration of drugs should be avoided.

For prolonged surgical operations, where depth of anaesthesia and muscular relaxation is not required, intravenous injection of a barbiturate combined with gas-oxygen is an excellent method. Plastic surgery has proved to be an admirable field for this technique (Magill). Avertin is also good, but the blood loss is rather more than with barbiturates. For cerebral surgery, oral nem-

butal with omnopon, followed by a very little anaesthetic and some oxygen, has yielded very good results. In gynaecological plastic surgery a similar method is recommended, for haemorrhage is thereby reduced (Fairlie). In thyroid surgery the barbiturates have received an extended trial, but I am not enamoured of the method. Certainly for a second operation on a patient who has already lost half her thyroid by the method of stealing it, the variety of routes enables one to put the patient to sleep without her knowledge. But the oral route is not sufficiently powerful for these highly sensitive nervous systems, or at least a good deal of inhalational anaesthesia must be added. Furthermore, the intravenous injection of a barbiturate into a patient whose heart is exhausted from Graves's disease is a highly dangerous procedure. These patients may be almost moribund, and the slight fall in blood pressure occasioned by the injection, together with the small degree of cyanosis which often accompanies it, may prove fatal. Excellent results usually are obtained with avertin preceded by omnopon and hyoscine, and followed by local anaesthesia, with gas-oxygen if necessary.

Ear and throat surgeons are, I think, divided in their opinions. For simple operations in nervous patients, such as tonsillectomy, the pre-operative sedation with oral nembutal may be helpful. But in operations on the upper air passages, the prolonged period of dulled cough reflex, together with restlessness, is apt to lead to trouble during the hours following operation. During septum operations and other procedures under local anaesthesia, absolute quietude is not always obtained, and the operation may be impeded by the restlessness and talkativeness of the patient. I think laryngologists will agree that avertin gives a quiet sleep, more rapid recovery, and less restlessness.

In dental surgery the barbiturates should be used with discretion. If the operation is an extraction in the dental chair, an exceedingly nervous patient may be helped to take gas peacefully when a dose of nembutal has been swallowed beforehand, but the dentist must be prepared to keep the patient on a couch for several hours afterwards. For larger procedures such as the extraction of many teeth in a nursing home, the quiet anaesthesia resulting from a combination of general anaesthesia with a barbiturate is very pleasant. But should the tooth sockets bleed after the patient has returned to bed it is often difficult in such cases to make the patient bite on to swabs in order to stanch the haemorrhage. Intravenous sodium evipan, which is detoxicated more rapidly than the other barbiturates, enables the patient to recover consciousness and a completely active cough reflex more rapidly, and it is probable that it will serve a useful purpose both in laryngology and in dentistry.

This drug is receiving a good deal of attention just now. Induction of anaesthesia is quicker, narcosis may be taken to a greater depth with safety, and recovery is rapid. By itself the uses of the drug are, I think, somewhat limited. It is not usual for full anaesthesia to last for more than a quarter of an hour. Therefore, if the drug be given while the patient is in bed, there is not much time in which to take him to the theatre, to prepare him for the operation, and to perform it. In most cases it is necessary to continue with an inhalational anaesthetic. For tooth extractions, for the setting of fractures, for painful dressings, and for brief gynaecological procedures, the drug seems to be valuable, but I do not find that the indications for its use are by any means numerous. If one dose only is to be given, without any other anaesthetic, it is usually necessary that the patient should be fully prepared on the operating table before the injection is begun. Surely less pleasant than a general anaesthetic! In my experience there is a period of an hour or more following the stage of

narcosis when the patient is drowsy and sometimes incoherent. I find that post-operative restlessness is not so marked with sodium evipan as with nembutal.

In obstetrics the barbiturates have received a considerable test. My own experiences may be summarized as follows. Usually a full dose of sodium amylal or of nembutal injected intravenously just before full dilatation will produce painless labour. It does not affect the frequency of contractions; usually it appears relatively to increase the expulsive force, and the drug does not lead to any embarrassment of the child. The placenta is born speedily, and post-partum haemorrhage, in my experience, is reduced. This full dose should be given very slowly, otherwise the fall in blood pressure will very properly deter one from giving the full dose which was intended, with the result that full analgesia would not be obtained. It is noteworthy that when the regular contractions of labour have set in, they continue with the same rhythm both during and after the injection of the drug.

When the head is on the perineum progress is not delayed so much as in ordinary labour, and there is the danger that the child may be shot out precipitately, with a severe tear of the perineum as the result. At the time of delivery some patients wriggle about so much that it is not an easy matter to control them and to deliver the head quietly and steadily. The administration of gas-oxygen gives valuable aid at this time, but in a confinement under the influence of a barbiturate the presence of two trained attendants is essential. This uncontrolled restlessness is present in most cases delivered after the oral administration of nembutal, while, furthermore, with oral nembutal, analgesia is usually not complete. Avertin has given excellent results, but it is, I think, true to say that sometimes the rectal injection of avertin solution is returned, labour tends to be delayed, and the child's respiration may be depressed.

In Caesarean section performed under spinal anaesthesia, nembutal by the oral route is a useful sedative. In these cases the fear of depression of the child's respiratory centre precludes us from the use of morphine; but nembutal soothes the mother, and it enables the child to be delivered in a vigorous state. It is true that sometimes the child may be rather sleepy, but respiration is easily aroused. Intravenous nembutal should be avoided, for the fall in blood pressure induced by the combination of intravenous barbiturate and spinal anaesthesia may be of an alarming degree—as some of us know from experience.

In general medicine nembutal and its allied compounds have proved to be helpful. In a case of strychnine poisoning the convulsions were controlled, death was averted until the effects of the drug had worn off, and recovery ensued. It is claimed that strychnine may be employed in barbiturate poisoning, and successful cases are cited. As much as 1/6 grain has been injected hypodermically every six hours. Several cases of tetanus in my own experience have been controlled by intravenous nembutal: at least two with a successful cure. Status epilepticus offers a field for the more vigorous barbiturates. For cardiac insomnia the sound sleep promoted by nembutal has afforded substantial improvement to the heart. Delirium tremens, mania from various causes, and persistent hiccup are examples of conditions which have benefited greatly from the use of basal narcotics.

We may now consider certain conditions in which the administration of barbiturates is fraught with increased risk for the patient. Sir Willam Willcox on many occasions has emphasized the risk of pneumonia in those individuals who have received a large dose of a barbiturate. Therefore in the presence of inflammation of the lungs, in operations for empyema, and even in

catarrhal conditions of the bronchi and upper air passages barbiturates should be withheld. In my experience avertin does not involve so great a risk, and if other conditions warrant the use of avertin, the inhalation of a gaseous anaesthetic is reduced in amount and, indeed, may be avoided if local anaesthesia is effective.

When the efficiency of the liver or the kidneys is affected by toxic blood conditions, by local inflammation of those organs, or by other diseases, such as eclampsia or cirrhosis, the fear of further damage to them, together with coma as the result of retarded detoxication and excretion of barbiturates or avertin, will be a sound reason for withholding the drug. It has been remarked by gynaecologists that upon opening the abdomen of patients who have received nembital the bladder appears to be rather more full than usual. It seems reasonable to think that a certain amount of diuresis is caused by these drugs. In prostatectomy, when the fear of renal insufficiency is particularly acute, a barbiturate would seem to be an unnecessary load.

I have on several occasions given nembital or avertin with gas and oxygen to patients with diabetes of mild degree. The results have been uneventful, but avertin appears to be preferable in such conditions. Should coma follow the giving of a barbiturate to a diabetic, I should perform lumbar puncture as Purves-Stewart and Willcox have recommended. These authorities state that in coma caused by a barbiturate the drug can be detected in the cerebro-spinal fluid, and that removal of a quantity of the fluid by lumbar or cisternal puncture always produces at least temporary improvement.

The state of the heart is of importance. In the presence of heart disease, if signs of active toxæmia are absent, the use of avertin with gas and plenty of oxygen is a most valuable measure. In heart disease associated with severe toxic goitre I am quite sure that the intravenous injection of nembital is dangerous. It may be that the fall in blood pressure which often accompanies this method is the factor which reacts indirectly on the heart, or the problem may be a complicated one concerned with the poor condition of the liver, kidneys, and so forth, but the practical point remains that a toxic heart should not receive an intravenous barbiturate. Even oral nembital may cause pallor and a lowered blood pressure in apparently normal people. Reference has already been made to the risks of administering an intravenous barbiturate and then injecting a spinal anaesthetic; for the blood pressure may drop to an alarming extent.

There are local conditions of the stomach or bowel, such as inflammation or perforation, which should preclude the introduction of a narcotic solution into the diseased viscus. Some of the conditions such as gastritis, gastric ulcer, perforation, and colitis have already been referred to, and there does seem to be some risk in giving rectal avertin in cases of appendicitis or diverticulitis, particularly if perforation is feared.

It is perhaps well to emphasize the need for making certain that the patient is absolutely ready for operation before the administration of a basal anaesthetic is begun. The operator may desire to make a further examination or to speak to the patient after he has been brought to the anaesthetic room. During the recovery period from anaesthetics in which barbiturates and avertin have been employed, patients often become exceedingly restless. The restlessness is less marked following avertin or sodium evipan. Such restlessness definitely increases the possibility of post-operative recurrent haemorrhage. Very small doses of morphine or omnopon (repeated if necessary) usually control the restlessness. The administration of oxygen is sometimes helpful.

Although basal anaesthetics are a boon to patients, I am not sure that nurses find them convenient. The

preparations beforehand are more complicated than in routine anaesthesia, but the principal disadvantage from the nursing point of view lies in the recovery period. The respiration may be depressed, the tongue may fall back, and the patient may be restless. These conditions usually require that a competent nurse shall sit by the patient for an hour or more after he has returned to the ward. Furthermore, as I have already mentioned, the after-effects of barbiturates may be prolonged, and a relatively small dose may confuse the patient's mind for many hours. This confusion often persists longer than the onlookers realize, so that nurses must be informed of every patient who has received a barbiturate. In the case of avertin a small degree of respiratory depression and trouble with the tongue is not uncommon, but prolonged unconsciousness, amnesia, or confusion is rare.

THE ANAESTHETIST AND BASAL ANAESTHETICS

I have left the anaesthetist's point of view to the last. It is always advisable that an anaesthetist should see a patient on the day before operation, but if a basal anaesthetic is to be given, by the mouth or by the rectum, the preliminary visit is essential. Even with intravenous methods time should be given for a very full consideration of all aspects of the case before the drug is administered.

I have already referred to many of the considerations which must be borne in mind in selecting the particular drug. Sodium amytal has a greater duration than nembital; it is said that the post-anaesthetic restlessness also is greater, but I am not sure. I have found that pernocton (which is given by the intravenous route) is not so powerful as the two I have just mentioned. Sodium soneryl and hebaral I believe are relatively weak when given in safe doses. Sodium evipan is dramatically effective, but the full ordinary dose of 1 gram does not secure a prolonged effect in every case. The degree of muscular relaxation varies. Jarman, who has carried out extensive clinical investigations, precedes the intravenous injection of sodium evipan with a hypodermic injection of omnopon-scopolamine. In some cases, as the effects of the first injection are wearing off, he administers a second. He has used sodium evipan alone successfully in many cases of appendicectomy. On one occasion he gave four injections of sodium evipan for an operation which lasted nearly two hours, and no other anaesthetic was required.

Dosage.—This is a matter of very great difficulty, and I have already indicated the need to take into consideration the type of the operation and the personal equation of the patient, but the most useful aid is the patient's weight. In the case of avertin a dose of 0.1 gram of the drug for each kilogram of body weight yields fairly uniform results. It is claimed by some anaesthetists that 0.12 gram per kilogram will yield complete anaesthesia in 60 per cent. of cases, but I prefer to stick to the smaller dose of 0.1 gram. When employing intravenous methods greater precision may be attained. It appears to me that usually, at the end of the injection, the anaesthesia begins to lighten almost immediately, but the fall in blood pressure continues for some minutes before it rises once more.

To sum up: (1) it does not seem wise to give a basal narcotic unless the patient has been examined carefully beforehand; (2) the oral route for the barbiturates is convenient, but it may be ineffective or, on the other hand, the effects may be too prolonged; (3) the intravenous route is not always safe; (4) avertin seems to be less convenient but perhaps more reliable: the dose is assessed with greater accuracy and the liver appears to be able to detoxicate the simple molecule of avertin rapidly.