

CLINICAL EXPERIENCE WITH SURITAL SODIUM*

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SURITAL sodium was introduced to the Canadian market this year as a proven intravenous anaesthetic agent. For this reason it was felt timely to discuss the place of Surital in present day clinical anaesthesia.

It is gratifying to note that Surital has had a long and careful laboratory and clinical trial, over a period of seven years, before it was released to the open market. There have been frequent reports in the literature during these past seven years and many thousands of cases have been reviewed. P. C. Lund (1) has perhaps the largest series with some six thousand cases reported and a total of fifteen thousand anaesthetics in which Surital played a part.

Nor is the present paper the first mention of Surital in the Canadian literature. In an excellent article Gain, Yates, Hoar and Watts (2), reported their experience and suggested that further use of Surital was indicated. This present paper is based on a review of the literature and a relatively small series of cases. One hundred and fifty cases are reported and since the paper was written there have been an additional fifty cases in which Surital has been used.

The series is small because it comprises part of the work of one individual during the spring of 1954. Nevertheless interest has been added by a detailed discussion of several representative cases so that the method of use and the doses employed may be easily followed.

Surital Sodium is also called Thiamylal Sodium. The chemical formula is: Sodium 5-allyl 5-(1 methylbutyl)-2 thiobarbiturate. Surital is the sulphur analogue of Seconal Sodium, just as Pentothal is the sulphur analogue of Nembutal. Because of this close chemical similarity one would expect Surital and Pentothal to be much alike as anaesthetic agents. Surital is an ultra-short acting thio-barbiturate. In this group of cases it was used intravenously in the 2½% solution. Like Pentothal it may be employed by continuous intravenous drip, .03% solution (3), as a hypnotic for psychological or psychiatric examination (4), or by rectal instillation (5).

The present product is much improved over early experimental samples. This point is emphasized because there are many who might remember, with distaste, the thick brown and rather sticky powder which was the earliest product. Surital, as supplied to-day, is a light yellow powder that is easily dissolved in distilled water producing a clear yellow solution. It has a sulphur odour somewhat stronger than that of Pentothal. It is packaged as a fine powder, in ampules or rubber topped vials of one gram each.

Intravenous anaesthesia is admittedly popular with most of us. It has been a very humane contribution to medicine. It is demanded by those of the laity who have previously received it as an anaesthetic. Yet despite all this, intravenous

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anaesthesia has its detractors. Especially is this true since the advent of curare and the combination of an intravenous anaesthetic and a curare-like drug in a rapid injection for facilitating endotracheal intubation. We would be wise to listen to those who warn us, for the very ease of administration of these drugs may lead to respiratory depression. It is thought to-day, that oxygen lack is the greatest single factor in the production of cardiac arrest, whether it stems from short anoxia or long continued hypoxia.

The patient undergoing mitral commissurotomy is a fine index of the effect of rapid thiorbarbiturate injection. Unless the induction dose is limited to approximately ten cubic centimetres of a two and one-half percent solution, or preferably less, and the induction time spread over ten or fifteen minutes, there is an alarming drop in blood pressure and increase in pulse rate. These factors may result in cancellation of the procedure at hand.

The elderly, the shocked, and the very young patient behave in a similar manner to the patient with mitral stenosis, though often not in such a dramatic fashion. The average young adult does not respond to such a degree and this is probably one reason why the rapid injection technique has stealthily crept to popularity.

The present trend in our thinking (6), is for slower injection with intervals between injections. Not all will agree with this, but we must not let such useful drugs fall into disrepute through lack of consideration of our method of use.

It is with these thoughts in mind that a reiteration of certain basic principles of the use of intravenous anaesthetics is presented. If some points are lacking, or if disagreement is evident, it is hoped that these will be corrected by the discussion.

- 1 The intravenous anaesthetic should be administered slowly and with a pause between each injection.
- 2 Lack of oxygen should be guarded against by oxygen administration at the earliest suitable moment. Respiration must always be adequate and failing this, must be assisted.
3. In the elderly, the debilitated or shocked patient intravenous anaesthesia should be used in minimal doses and preferably as an inducing agent only.
4. It is wise never to exceed a total dose of one gram of a thiorbarbiturate in any one anaesthetic. This principle was adhered to in the present series.
5. Patients with impaired liver function or severe asthma should never receive a continuous intravenous anaesthetic. Some anaesthetists agree that a minimal dose given carefully may be allowed to facilitate a smooth and humane induction.
6. Atropine or hyoscine should be administered prior to any intravenous anaesthetic.
7. An anaesthetic machine which is suitable for efficient artificial respiration should be available at every administration of an intravenous anaesthetic. It is preferable not to use the intravenous anaesthetic alone even for very short procedures but always to supplement with a high degree of oxygen.

A drop in blood pressure is the usual sequel to the injection of an intravenous anaesthetic. This appears to vary directly with the speed of injection and the

amount of anaesthetic agent used. With a slow induction and pauses between injections, as previously mentioned, the blood pressure drop will be kept to a minimum.

Bigelow (7), has noted that the arterial oxygen saturation may drop ten or more percent during the induction with an intravenous anaesthetic if oxygen administration is not constant and adequate. This may be unimportant in the otherwise healthy young adult but on the other hand it may be extremely dangerous in people with mitral stenosis, other forms of heart disease, hypertension, shock, extreme debility, or the very young or old. In these cases, therefore, our technique should allow gentle oxygen administration by mask concurrently with the intravenous injection. The patient should be advised that the mask will deliver oxygen only and that the intravenous injection will induce a pleasant dreamless sleep.

Breakdown of Cases

There are a total of one hundred and fifty cases in this series. Of these, one hundred and twenty-five were combined anaesthesia where Surital was used throughout in combination with nitrous oxide and oxygen and on occasion with the addition of a relaxant drug alone, or trilene alone, or with both a relaxant and trilene used. D-tubocurarine, Flaxidil, Syncurine and Anectine were the relaxant drugs employed. Surital was used for induction alone in twenty-five cases. In these cases the maintaining anaesthetic agent was cyclopropane, cyclopropane and a relaxant drug, cyclopropane and ether or ether and oxygen given by the anaesthetic machine and employing the endotracheal method. In the latter group cyclopropane was used after the endotracheal tube was passed until the patient was sufficiently anaesthetized to tolerate the gradual introduction of ether into the system. Most of these twenty-five cases were for upper abdominal surgery where maximum relaxation is required. It seems reasonable to many anaesthetists not to employ intravenous barbiturate anaesthesia to maintain these cases. To do so is to add a respiratory depressant without gaining anything in the field of relaxation. It appears wiser to use the more profound anaesthetics in upper abdominal surgery. Then too, we must not neglect the use of spinal anaesthesia which appears to have lost its vogue in recent years with the advent of curare.

Of the one hundred and fifty cases, forty-five were general surgery which included plastic and thoracic surgery. There were thirty-eight gynecological cases, twenty-one orthopaedic cases, eighteen otolaryngological cases, fourteen neurosurgical cases, nine ophthalmological cases, eight genito-urinary cases and two dental cases.

Balanced anaesthesia using Surital, nitrous oxide and trilene with or without relaxants has been found a most pleasing combination for gynecology, otolaryngology and orthopaedic surgery: in fact almost anywhere except in upper abdominal surgery. The addition of Trilene has made for better aeration by the reduction in the requirements of Surital and relaxant drugs.

A direct flow system with an easy blow off valve has long been popular in England and has recently had its adherents in the United States (8). Such a

system is to be found in the English Boyle's machine. The Heidbrink machine may be adapted using the Trilene attachment. This system has several advantages over the circle system when using nitrous oxide.

1. There is no carbon dioxide build-up as the large volume of gas prevents return of respiration.

2. It has been shown (10) with the circle system that if the bag is not regularly and repeatedly emptied the nitrous oxide tends to increase at the expense of the oxygen in the system because of oxygen metabolism. In the direct flow and blow-off the nitrous oxide and oxygen remain constant.

3. There is less work for the patient with a large volume, loose blow-off valve and the absence of a return valve.

The rationale behind the direct flow is that the average individual has a tidal exchange of five litres per minute. Most often six to nine litres of gas are employed in the non-rebreathing method which covers the tidal volume, makes it easily available to the patient and prevents re-breathing.

Surital combined with nitrous oxide, oxygen, Trilene and relaxants is, of course, non-explosive.

Endotracheal anaesthesia was used whenever indicated and this was facilitated by the use of anectine intravenously, and on occasion a 5% cyclaine, 2% pontocaine or 4% cocaine spray to the cords and upper trachea.

One death occurred in this series. The patient was a 72 year old man who appeared much older. He was emaciated and lying in bed with side-boards. He had been *non compis mentis* for several years following a stroke which left him hemiplegic. He had suffered two cardiac infarctions and was also suffering from rheumatoid arthritis. Following an attack of pneumonia he had fallen and fractured the neck of his femur. He was nursed at home for ten days but appeared to be in such a state of helpless misery that his relatives found it intolerable and on their persuasion an attempt was made to obtain fixation of the fracture with a Smith-Peterson nail. Surital, 9 c.c. of a 2½% solution was used together with 1 c.c. of Anectine and the patient was intubated and carried on nitrous oxide and oxygen, 4 litres to 2 litres. A further 3 c.c. of Surital and 2 c.c. of Syncurine were used intermittently to control light anaesthesia as evidenced by increasing speed of respiration or objection to the tube. Respirations were periodically assisted, pulse was 96 and blood pressure 120 for three-quarters of an hour, when just prior to pinning the hip, respirations ceased and pulse could no longer be felt. Pure oxygen by manual pressure brought a return of respiration and pulse but both disappeared spontaneously when the actual pinning took place. Oxygen by manual compression was of no avail. Cardiac massage was of course out of the question. The coroner's diagnosis was "operative shock". The operation was a desperate one undertaken for humanitarian motives. The desperate chance would probably have failed with any form of anaesthesia.

Two other patients of similar age both had hips pinned with similar doses of anaesthesia and were responding on being moved to bed. One of these patients had chronic myeloid leukaemia with a spleen as large as a football. In the other case Trilene was used with 4 to 2 nitrous oxide and oxygen after an initial dose of 8 c.c. Surital, 2½%, and 1 c.c. of Anectine and endotracheal intubation, no

other relaxant or intravenous anaesthetic being used. The latter is probably a better anaesthetic for this type of case.

In this series of one hundred and fifty all cases received a total dose of approximately one gram of Surital or less.

In cases of surgery of the eye, and others where the plane of anaesthesia is light, it is useful to spray the cords. This minimizes or eliminates coughing during the operation or on removal of the tube.

All cases for bronchoscopy should be so thoroughly sprayed with local anaesthetic prior to anaesthesia that the procedure could be carried out under the local anaesthesia alone. Here the Surital is used merely for sleep and the protection of the patient from an uncomfortable procedure. Oxygen should always be added, by first flooding through the mask and then a continuous flow down the arm of the bronchoscope.

A more detailed examination of some of the cases is in order to show the doses of anaesthetic used.

Case No. 1. Operation. Dilatation and curetage and posterior colopotomy.

The patient was a 25 year old woman. Surital 2½% was given intermittently up to a total dose of 20 c.c. or one-half gram. Nitrous oxide and oxygen was administered at the rate of 4 litres to 2 litres. There was a drop in pressure during the procedure from 110 systolic to 100 systolic. Generally a patient undergoing this operation or one of similar magnitude will require from 14 to 20 c.c. of the 2½% solution of Surital along with nitrous oxide and oxygen. It is again emphasized that where the circle system is used the bag is emptied periodically and refilled with oxygen to keep the nitrous oxide: oxygen ratio more even. This is done because oxygen is constantly being used in the patient's metabolism. Emptying the bag periodically is especially important in longer procedures where nitrous oxide tends to build up in ratio because of oxygen consumption. The meters may read a ratio of 2 to 1 but this does not mean the patient is receiving this amount after several minutes of anaesthesia.

Case No. 2. Operation: Hysterectomy. Mrs. H. Age: 43.

Thirty-five c.c. of 2½% solution of Surital was used intermittently along with 7 c.c. of D-tubocurarine. Nitrous oxide and oxygen were administered by the semi-closed circle method. The systolic blood pressure pre-operatively was 130 and during the operation dropped to 120 where it remained.

A 19 gauge needle is used and an intravenous infusion started in all cases which will last one hour or longer. In this way a plugged needle is avoided. A 17 or 18 gauge needle should be used if blood is likely to be administered.

In many gynecological procedures and in perineal cases generally the blood pressure may take a profound drop in the recovery room. This appears to be independent of the type of anaesthesia used. It also occurs in addition to the 10 degree drop in systolic pressure seen on moving the patient off the operating room table and into the bed. The patient with this drop in pressure has a slow pulse and closely resembles the picture of neurogenic shock or the shock seen with spinal anaesthesia. Indeed, these people respond rapidly in the same way to anaesthetics. The syndrome is not identical to the one seen following a carbon

dioxide build-up in the closed absorption technique for in that case there is the preceding rise in blood pressure and increase in depth of respiration.

An attempt has been made to maintain the blood pressure by intermittent injections of methedrine, minims three, intravenously, followed by minims five intramuscularly should the blood pressure tend to fall. This procedure is not always successful and may have to be repeated in the recovery room. It should be pointed out that these patients do not exhibit signs of curare or barbiturate overdose.

Case No. 3 Operation: Repair of Shoulder Cuff. Mr. F. Age: 52.

This orthopaedic procedure lasted three hours in the semi-sitting position. The patient was supine when induced with Surital given intermittently up to one-half gram. Mixed with the Surital was 3 c.c. of Syncurine. This mixture has been found useful in carefully handling the larger robust individuals with short thick necks and prominent teeth, or permanent artificial bridges. In these patients too, the Macintosh laryngoscope is the instrument of choice as the teeth may be absolutely avoided. In addition to the Surital and syncurine 2½ c.cs. of Anectine were followed by intubation. Oxygen was administered by gentle bag pressure until intubation took place. The patient was carried on nitrous oxide and oxygen, four litres to two. The remainder of the Surital was used intermittently as was intermittent curare up to 5 c.cs. The pulse and blood pressure were maintained throughout. At the end of the operation a large plaster sock was applied; and the patient was placed in bed on his back. He awoke on being returned to bed with no nausea or vomiting. This of course is a boon to this type of case and clearly shows the value of the combined type of anaesthesia for orthopaedic procedures.

Case No. 4 Operation: Mitral Commissurotomy. Mrs. M. Age: 38.

This patient gave a history of decreasing exercise tolerance, shortness of breath, and haemoptysis, denoting pulmonary hypertension. She also had rhonchi throughout both lungs.

At operation she had a tight mitral valve. Her left lung collapsed poorly and early in the operation she had a mild bronchospasm relieved by gentle bag pressure with ether vapor in oxygen. The anaesthetic was slowly induced over a period of twenty minutes with 11 c.c. of Surital 2½%. She was then given 3 c.c. of syncurine and her larynx and upper trachea were sprayed with 5% cyclaine. Another 1 c.c. of Syncurine was used. The patient was then intubated with a cuffed endotracheal tube. The Macintosh laryngoscope was used to avoid touching her complete front artificial porcelain dentures.

The patient's blood pressure remained absolutely the same during the slow induction. As the patient was slowly becoming drowsy it was explained to her that oxygen would be given by the face mask. This was kept up constantly except for the moments of spraying and intubation.

Her blood pressure dropped to zero on the fracturing of the mitral valve and the visible heart became slow and flabby. It responded quickly to artificial respiration with pure oxygen.

In these cases it is wise to inflate the left lung from time to time and this inflation is imperative if the heart beat changes or the heart muscle loses its tone.

This patient was maintained on ether and oxygen, only three-quarters of an ounce of ether was used during the operation. No further relaxant or Surital was used after the original induction.

It is efficacious to have an assistant, such as one of the anaesthetic internes, help during the commissurotomies, as the constant vigil of watching the patient prevents the anaesthetist from attending to accurate charting and transfusions etc.

Case No. 5. Abbe Repair of Hare Lip. Miss W. Age: 40.

In this procedure the lips are sutured together so that it is imperative to have the patient awake and in control of their reflexes when it is completed and avoid nausea, vomiting and excess mucus.

The patient was slowly induced with an intermittent injection of 12 c.cs. of 2½% Surital. Following this she was given two c.cs. of 2½% Surital, followed by two c.cs. of Anectine intravenously. The nose and pharynx and cords were sprayed with 5% cyclaine. An endotracheal tube was passed gently by the nasal route and "blind" intubation accomplished. During the operation she was carried on nitrous oxide and oxygen, four litres to two litres. A further 8 c.cs. of Surital was given intermittently in one c.c. injections.

The anaesthetic lasted 45 minutes. The blood pressure remained at 120 systolic and the pulse at 84. There was no nausea or vomiting, the patient was stirring at the end of the operation and on removal of the tube she responded to questioning by nodding her head.

Case No 6 Operation: Lumbar Laminectomy for Extruded Intravertebral Disc. Mr. F. Age: 40.

Surital 2½% solution was given intermittently up to 14 c.c. This was followed by cyclaine 5% spray to the larynx and upper trachea. Oxygen was given by mask intermittently until intubation. An endotracheal tube was passed without the use of relaxant drugs. There was no coughing on the tube. The absence of coughing may be obtained by local spray and is most desirable in neurosurgical operations where there is increased intracranial pressure and in ophthalmological surgery. Indeed it is ideal wherever the anaesthetic is kept on a light plane.

The patient was placed in the prone position and carried on nitrous oxide and oxygen, 6 litres to 3 litres with the English Boyle's machine, using Trilene in the flow. From time to time further Surital was added intermittently as was Flaxidil. This was found necessary in a large and robust patient. A total of 35 c.c. of 2½% Surital was used as well as 6 c.c. of Flaxidil. The operation lasted 2½ hours. There was an initial blood pressure drop of 10 points systolic, from 110 to 100. Five minutes later the blood pressure had returned to 110 systolic where it remained. The patient was responding at the end of the operation.

Case No. 7 Operation: Tonsillectomy and Adenoidectomy. Master A. Age: 6

In order to use Surital by the intravenous route in children it is imperative to gain their confidence and explain the procedure simply. The needle may be

compared to the toxoid injection with which the child is familiar or with the pre-operative atropine injection he has received.

One must be sure that the first venapuncture is successful and it is wise to have the vein optimally distended. A sharp 21 gauge needle is used. This child received 6 c.cs. of 2½% Surital intravenously by intermittent injection, then one c.c. of Anectine followed by oxygen and a further 6 c.cs. of Surital after intubation. The patient was carried on nitrous oxide and oxygen, 6 litres to 3 litres, and Trilene with the Boyle's machine. There was no additional Surital. The patient responded at the end of the operation with no vomiting.

Case No. 8. Operation: Colon Resection. Miss B. Age: 53.

Surital 2½%, 14 c.cs. was given slowly intravenously by intermittent injection followed by Anectine 2 c.cs. An endotracheal tube was passed and the patient was then carried on cyclopropane and oxygen. Six c.cs. of d-tubocurarine were given intermittently into the intravenous tubing.

Case No. 9. Operation: Detached Retina. Mrs. A. Age: 60.

Surital 2½% was given intermittently up to 12 c.cs. This was followed by 2 c.cs. of Anectine. Oxygen was administered all the while. A 5% spray of cyclaine was blown into the cords and into the upper trachea. An endotracheal tube was passed using the Macintosh laryngoscope. The patient was carried on nitrous oxide and oxygen and Trilene using six litres to 3 litres of the gases and employing the Boyle's machine. Intermittent injections of Syncurine up to a total of 5 c.cs. were made.

There was no coughing on removing the tube and the patient was wide enough awake to return to her room lying on her back, which is desirable in the operation for detached retina and which is of course impossible if the patient remains unconscious.

Conclusions

Surital Sodium is a most satisfactory intravenous anaesthetic agent. The close chemical similarity to Pentothal Sodium is borne out clinically where the two agents appear to be best used in equivalent doses.

Those who are familiar with the administration of Pentothal Sodium may safely use Surital Sodium in an identical manner.

The advantages and disadvantages of Pentothal Sodium appear to be true for Surital Sodium.

SUMMARY

1. One hundred and fifty Surital Sodium anaesthetics are reported.
2. A reiteration of the basic rules for the administration of intravenous anaesthetics is presented.
3. Surital combined with nitrous oxide, oxygen and Trilene by the continuous flow system is discussed and advocated.
4. Several cases are examined in detail to emphasize dosage and more clearly explain the administration of this anaesthetic agent.

RÉSUMÉ

1. On rapporte 150 cas d'anesthésie au Surital de Sodium.
2. On présente une réitération des règles fondamentales pour l'administration des anesthésiques intraveineux.
3. On conseille l'emploi du Surital combiné à l'oxyde nitreux, l'oxygène et le Trilène suivant le système de l'écoulement continu.
4. Plusieurs cas sont examinés en détail pour souligner le dosage et pour expliquer plus clairement l'administration de cet agent anesthésique.

Conclusions

Le Surital de Sodium est un agent anesthésique intraveineux très satisfaisant. Sa ressemblance chimique étroite avec le Pentothal de Sodium est confirmée en essais de clinique où des dosages équivalents des deux agents semblent produire les meilleurs résultats.

Ceux qui connaissent la technique d'administration du Pentothal de Sodium peuvent se servir avec sécurité du Surital de Sodium d'une façon identique.

Les avantages et désavantages du Pentothal de Sodium semblent s'appliquer également au Surital de Sodium.

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