PENTOTHAL SODIUM: ITS USE IN CONTINUOUS INTRAVENOUS ANESTHESIA AND A METHOD OF PRESERVING IT IN SOLUTION * †

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EVER since 1934 when Lundy and Tovell (1) first used pentothal sodium, various methods have been advocated for its administration but the most common is still the intermittent syringe technic. Pentothal sodium is most commonly given in a 2.5 per cent solution although 5 and occasionally 10 per cent solutions are being used. During the past two years several anesthetists have reported the use of higher dilutions of pentothal sodium (2, 3, 4, 5, 6). They have found that dilutions of pentothal sodium of 1 to 0.1 per cent (1:100 to 1:1000) are practical, often safer, easily administered, and more economical than the less dilute solutions. For the past two years I and my fellow anesthetists in the department have used 0.4 to 0.1 per cent (1:250 to 1:1000) dilutions of pentothal sodium in 1200 cases.

The 0.4 per cent (1:250) dilution is made by simply adding 4 Gm. of pentothal sodium to a regular commercial liter bottle of 5 per cent glucose in normal saline solution. The bottle is then suspended 2 to 3 feet above the level of the patient and the solution conveyed to the patient's vein by means of a glass drip meter, rubber tubing, and needle. A glass drip meter is inserted into the bottle and a screw clamp is used on the tubing to regulate the rate of flow. It is usually advisable to use a number 18 gage needle to permit rapid injection of the solution. This size needle is especially important when this solution is being used as the only anesthetic agent.

TECHNIC FOR ADMINISTRATION

Pentothal sodium in dilution of 0.4 per cent (1:250) can be used for all conditions in which the 2.5 per cent solution would be selected. Some anesthetists are fearful that the 0.4 per cent dilution will take unduly long to produce an effect. When a number 18 gage needle is used and the solution is injected rapidly, the time factor very closely approaches that of the 2.5 per cent solution. The slightly increased time factor offers greater safety to the patient.

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When anesthesia is induced with the 0.4 per cent solution the fluid is allowed to flow in a steady stream or to drip rapidly. The patient is asked to count out loud and ordinarily will be asleep in forty-five to seventy-five seconds. This does not mean that anesthesia will be sufficient for exceedingly painful procedures and, as with any pentothal sodium anesthesia, more may have to be injected. Once the desired depth of anesthesia is reached the rate of flow is reduced. One of the main advantages of this technic is that the level of desired anesthesia can be more easily controlled since there is a steady drip and the danger of administering an excessive amount of the drug is greatly reduced.

This method offers ease yet accurate administration since, by occasionally adjusting the clamp on the tubing, the rate of flow can be regulated. Though the drip meter is regulated fast or slow the injection, obviously, is continuous. When the syringe technic is used it is necessary to keep injecting small amounts of the pentothal solution for the sole purpose of keeping the needle open. The continuous drip prevents blood from clotting in the needle which occasionally occurs with the syringe technic.

TECHNIC FOR PRESERVING PENTOTHAL SODIUM IN SOLUTION

During the past two years we have definitely proved that pentothal sodium in solution can be used and the remaining solution in the bottle be covered, kept sterile, and used again after several days. This solution can safely and effectively be used as an anesthetic agent without appreciably losing its potency. In the past we have discarded large amounts of pentothal sodium because it was believed that it was not stable when once placed in solution and the effort to keep the unused solution sterile did not warrant the trouble. Not only can the solution be kept for several days but the liter bottle of pentothal sodium solution can be used for several patients providing (1) the anesthetist is careful never to lower the bottle below the site of injection; (2) he never allows the drip meter bulb to become filled and hence obviates any chance for reflux of the patient's blood into the bottle; (3) the anesthetist tightly closes the screw clamp on the tubing before removing the bottle from the standard and then disconnects the tubing from the bottle; and (4) the top of the bottle is sponged with an antiseptic solution and a sterile gauze pad of at least 6 thicknesses placed on the top of the bottle and firmly fastened with adhesive tape. A bottle of pentothal solution handled and covered in this manner may be safely stored at room temperature. This technic is simple. The prime objective is to keep the solution sterile so that the remaining pentothal solution can be used for succeeding patients.

If sterile technic is followed as outlined there should not be any danger of contamination. It may be argued that solutions of glucose are excellent culture media for bacteria, although solutions without

glucose work equally as well. I have followed this technic for storing "left over" solutions and have run cultures and controls for five consecutive days and found them sterile. The technic for determining the sterility of the solution is as follows:

Before being used a 5 cc. sample of the pentothal solution was injected into a large culture tube of brain-heart infusion broth. The solution was then used for anesthesia. After the anesthesia another 5 cc. sample of the solution was taken and cultured in the same manner. This same procedure was repeated for the next four days. The solution was stored at room temperature for the entire period. All of the cultures remained sterile after twelve days of incubation.

Mallinson (7) stated that he has used "bulk" pentothal sodium solution up to sixteen days. He then took a sample of this solution and found it sterile after seven days of incubation. He also proved that pentothal solution can be bactericidal. Testing this, he reported that 5 per cent solution, if diluted with three parts of water, kills hemolytic streptococci and staphylococci, and if diluted with an equal volume of water kills pyocyaneus. The 5 per cent solution was required to kill the proteus bacillus.

We have used this technic for two years for 1,200 cases and have never had any reason to believe that any of our solutions that we have stored have been contaminated. However, should the anesthetist harbor any doubt as to the sterility of the solution it doubtless would be wiser to discard it. If the anesthetist is careful to handle the solution as outlined and promptly covers the bottle after using, it rarely should be necessary to destroy any solution of pentothal sodium.

We have not found the loss of strength of the 0.4 per cent dilution to be of practical importance up to five days. Mallinson mentioned that he did not notice any loss of potency of the 5 per cent solution after sixteen days.

The fact that pentothal sodium in solution can be kept for several days is of paramount importance. The anesthetist who uses pentothal regularly does not have to take precious time or trouble to make new solution since he can keep one or more bottles on hand at all times. A considerable financial saving is made since left over pentothal sodium solution does not have to be destroyed. Any anesthetist who is regularly using pentothal sodium for anesthesia will profoundly appreciate these saving factors.

USE OF 0.2 AND 0.1 PER CENT (1:500 AND 1:1000) DILUTIONS OF PENTOTHAL SODIUM

The 0.2 per cent dilution (2 Gm. of pentothal sodium to 1000 cc.) and 0.1 per cent dilution (1 Gm. of pentothal sodium to 1000 cc.) are used in conjunction with local and spinal anesthetics. These solutions are a valuable adjunct to local and spinal anesthesia when the patient is nervous, apprehensive, or wishes to be asleep. Often the surgeon

believes that the patient would be well pleased with continuous light sedation which will in turn facilitate the surgical procedure. These dilutions of pentothal sodium are used solely for sedation and the anesthesia is dependent upon the local or spinal anesthetic agents. If the rate of the drip is sufficiently slow the pentothal sodium will be detoxified more rapidly than it is injected and the patient will awaken. Even when the patient has been "kept asleep" during the entire period of the surgical procedure he will promptly awaken when such high dilution of pentothal sodium has been used.

The 0.1 or 0.2 per cent dilution of pentothal sodium will give greater relief of nausea and vomiting than will 100 per cent oxygen. If the patient under spinal anesthesia experiences slight nausea and vomiting it is doubtless easier to give relief by the inhalation of 100 per cent oxygen. However, if the nausea and vomiting are persistent, the intravenous injection of 0.1 or 0.2 per cent dilution of pentothal sodium will give prompt, pleasant, and consistent relief throughout the entire period of the operation.

Fierst (4) and Adams and Gray (8) stated that pentothal sodium can be safely given to patients in shock but should be administered by experienced anesthetists who are aware of the low tolerance of these patients for the drug. We use 0.2 or 0.1 per cent dilution of pentothal sodium for surgical patients who are known to be poor risks. This high dilution offers a wide margin of safety and lessens the possibility of further depressing the patient. The relatively large amount of fluid injected with the pentothal helps to combat shock. We prefer to depend on a local anesthetic, in so far as possible, for the main anesthetic agent and limit the use of pentothal to sedation, or at most, light anesthesia. These patients cannot detoxify the drug rapidly and are easily depressed. If the amount of the pentothal sodium is not withheld to the absolute minimum the patient may not survive the anesthetic or may die shortly after the operation. There is definitely a wider margin of safety in using 0.2 or 0.1 per cent dilution of pentothal sodium along with continuous 100 per cent oxygen for patients in shock.

SUMMARY AND CONCLUSIONS

We have used 0.4 to 0.1 per cent (1:250 to 1:1000) dilutions of pentothal sodium in 1,200 cases. These solutions are made by simply adding pentothal sodium to any commercial liter bottle of 5 per cent glucose in normal saline solution. We have entirely discontinued the use of the 2.5 per cent solution and the intermittent syringe technic.

It has been definitely proved that pentothal sodium can be kept in solution for several days. Discarding pentothal sodium solution because it is "left over" is an expensive and unwarranted waste. Anesthetists who are regularly using pentothal sodium will appreciate the time and trouble they will save by this method and the patients and hospitals will truly value the financial savings.

REFERENCES

1. Lundy, J. S., and Tovell, R. M.: Annual Report for 1934 of the Section on Anesthesia, Including Data on Blood Transfusion, Proc. Staff Meet. Mayo Clin. 10: 257, 1935.
2. Lenowitz, H.; Lipson, H. I., and Stevens, E J.: High Dilution Pentothal Sodium for Sedation, Narcosis, and Anesthesia, Anesth. & Analg. 23: 78–81 (March–April) 1944.
3. Lundy, J. S., et al.: Annual Report for 1942 of Section on Anesthesia, Including Data and Remarks Concerning Blood Transfusion and Use of Blood Substitutes, Proc. Staff Meet. Mayo Clin. 18: 129–140 (May) 1943.
4. Fierst, C. E.: Continuous Sodium Pentothal in Cases Associated with Shock, Med. Ann. District of Columbia 15: 50–53 (Feb.) 1944.
5. Solkow, M. L., and Clements, A. B.: Pentothal Sodium Intravenous Anesthesia: A Modification in Technique of Administration, Anesth. & Analg. 21: 178–179 (May–June) 1942.
6. Raffan, A. W.: Continuous Intravenous Anesthesia with Sodium Pentothal at a Military Hospital in the Middle East, J. Royal Army Med. Corps 80: 257–261 (May) 1943.
7. Mallinson, F. B.: Apparatus for Preparing Pentothal in Bulk, Lancet 2: 472–474 (Oct.) 1944.
8. Adams, R. C., and Gray, H. K.: Intravenous Anesthesia in Case of Gunshot Wound Associated with Accompanying Severe Traumatic Shock and Loss of Blood; Report of a Case, Anesthesiology 4: 70–73 (Jan.) 1943.

The Hospital Section of the Post-War Planning Committee of the New England Society of Anesthesiology would like to hear from physicians who are interested in the peace time practice of anesthesiology in New England. This information will be made available to persons interested in obtaining the services of an anesthesiologist in their individual surgical practice, group or hospital in New England. It is felt that the collection and dissemination of this information may facilitate the proper relocation of anesthesiologists now in the service when they return to civilian practice.

The following information is desired from those interested: Age, medical school, year of graduation, internship (year and hospital), training in anesthesiology (in detail), length and type of training, chief of service, activity and specialty after completion of training, military experience in anesthesia, publications, membership in medical societies, present address and a permanent address.

Please send this information to the chairman of this committee, 605 Commonwealth Avenue, Boston 15, Massachusetts. Morris J. Nicholson, M.D., Chairman; Jacob H. Fine, M.D.; Sidney C. Wiggin, M.D.