Second Edition

Techniques and Procedures of

ANESTHESIA

By

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INTRODUCTION

The technique of anesthesia cannot be learned from books. For the most part, the instruction must be practical and can only be taught in the operating room. However, this practical instruction should be supplemented by organized lectures or classroom work.

The author has found that an outline of procedures based upon the fundamentals of anesthesia simplifies and expedites the process of teaching and learning for both instructor and pupil. This outline of procedures and techniques has been employed by the author as a guide for beginners in anesthesia.

It is obvious that an author cannot assemble a book of procedures which would please and satisfy every anesthetist who is engaged in teaching anesthesia. *The material which must be compressed into an outline of this sort is vast.* Adequate condensation is not possible without slighting topics and details which, to some teachers, may appear more important than the topics and details outlined.

Each anesthetist ultimately develops his own technique and manner of performing his duties. It would appear, then, that almost as many individual techniques exist for a given procedure as there are anesthetists. However, closer scrutiny will reveal that these seemingly varied techniques are all based upon the same fundamental principles and that they differ from one another only in minor details.

The techniques described in this book are those which illustrate fundamental principles and which the author has found adaptable for student personnel and suitable in his management of the Department of Anesthesia at Charity Hospital of Louisiana at New Orleans.

The author lays no claim to originality of any of the techniques outlined. Many have been employed for so long a period of time that they are now accepted medical practice. Others have been introduced recently and are described with modifications. Reference is made to the original description of a technique or procedure and its author, whenever this is possible, and particularly in the case of newer techniques The methods of regional anesthesia are based upon the approaches advocated by Labat and his teachers and pupils.

The author wishes to stress the fact that there is no such thing as a "routine" in the administration of anesthetics. Each situation and each patient which the student encounters presents a different problem. No two situations are identical. Each step in the performance of one's duties has an underlying reason behind its execution. The reason may be a physiologic, pharmacologic or other equally important fact. An attempt has been made in this outline not only *to enumerate the technical details* of anesthesia but *the associated reasons for executing them* in the manner described.

The conduct of anesthesia is influenced by such variable factors as the disease with which the patient is afflicted, the type of operation to be performed, the skill and dexterity of the surgeon, or the pharmacologic effect of the drug upon the patient. In order to be a skillful technician, the anesthetist must possess a knowledge of the fundamental sciences, diagnostic acumen, and that faculty which, in medicine, is known as judgment. The student will do well, if he wishes to balance his training, to pursue parallel reading in the fundamental sciences of anatomy, chemistry, physiology, pharmacology, pathology, and in clinical subjects related to the field of anesthesiology.

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PREFACE TO SECOND EDITION

A dozen years have elapsed since the material for the first edition of this book was assembled. During that time there have been numerous refinements and innovations in anesthesia. New drugs have been introduced requiring new techniques or modification of old techniques. Some of these did not stand the test of even a few years time and are no longer used. Others have proved useful and are with us yet. The more important of these advances and uses of new drugs have been included in this edition. It is hoped that this edition will continue to be as useful as the first has proved to be as evidenced by the continued demand for the volume during the past decade.

The writer is grateful to Dr. Meyer Saklad, to Dr. C. R. Stephen, and to Dr. Robert Hosler for the use of illustrations from their respective books, *Inhalation Therapy*, *Elements of Pediatric Anesthesia*, and *Cardiac Resuscitation*, and to Dr. Donovan Campbell and Dr. Roger Witt for assistance in proofreading.

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TECHNIQUES AND PROCEDURES OF ANESTHESIA

PART I

GENERAL CONSIDERATIONS

TYPES OF ANESTHESIA

The types of anesthesia may be classified according to the routes of administration of drugs employed.

The following types are available:

1. *Inhalation:* Narcosis is produced by inhalation of gases or vapors of highly volatile liquids.
2. *Regional:* Anesthesia is obtained by applying a drug along the course of a nerve. Sensation is abolished by one of the following methods:
   a. Spinal anesthesia: The drug is applied to the anterior and posterior roots and sympathetic fibers of the nerve as it passes from the spinal cord through the subarachnoid space.
   b. Epidural anesthesia: The drug is applied to the nerve as it passes from the dura but while it is still in the canal of the vertebral column.
   c. Nerve block: The drug is applied at some point along the course of the nerve before it divides into its terminal branches.
   d. Topical, field block, and infiltration: The drug is applied at the nerve endings. (Physical agents such as pressure and cold may be applied to nerve endings to produce anesthesia also.)
3. *Intravascular:* Narcosis is obtained by injecting an aqueous solution of a drug directly into the blood stream as follows:
   a. By intravenous injection.
   b. By intra-arterial injection.
   c. By intramedullary injection (marrow puncture).
4. *Rectal:* Narcosis is obtained by administering an aqueous or oily solution of a drug as an enema.
5. *Intraperitoneal:* Narcosis is obtained by injecting an aqueous solution of a drug into the peritoneal cavity. The drug is absorbed into the systemic circulation from the serous surface. This technique is limited chiefly to animals.
6. *Oral:* Narcosis is obtained by ingestion of solutions of drugs or the pure drugs so that they are absorbed through the upper portion of the gastro-intestinal tract.
7. *Subcutaneous and Intramuscular:* Narcosis is obtained by injecting aqueous or oily solutions of soluble drugs into these tissues.

Available Drugs

Drugs used for anesthesia are central nervous system depressants. Two types are recognized—the volatile and non-volatile.

Volatile drugs are gases or liquids with low boiling points. The currently used gases are nitrous oxide, ethylene and cyclopropane. The currently used liquids are *ether, vinethene, chloroform, ethyl chloride* and *trichlorethylene.*

The non-volatile drugs are solids or liquids with vapor pressures too low to be effective at room temperature. Currently used drugs are *avertin, chloral, paraldehyde, pentothal, evipal, surital, the narcotics, morphine, dilaudid demerol, methadon, nisentil* and *dromoran.*

The local anesthetics are non-volatile substances also. The currently used drugs are described in Part VI.

Combinations of Drugs and Routes

In present day anesthesia practice, combinations of drugs and routes are used. Some of the currently employed combinations are as follows:

1. Inhalation plus basal narcosis induced by injecting a non-volatile drug intravenously, intramuscularly or rectally. Example: nitrous oxide oxygen plus pentothal intravenously.
2. Inhalation plus basal narcosis plus a muscle relaxant. Example: nitrous oxide oxygen plus pentothal plus curare.
3. Regional plus inhalation. Example: spinal block plus cyclopropane.
4. Regional plus basal narcosis induced by injecting a non-volatile drug intravenously, intramuscularly or rectally. Example: spinal block plus pentothal.

GENERAL DUTIES OF THE ANESTHETIST

Duties	*Reasons*
1. The anesthetist should visit the patient in advance of operation in order to evaluate the patient as an operative risk and to decide upon premedication, type, and techniques of administration of anesthesia.	Familiarity with the patient's abnormalities is necessary in order to avoid the many pitfalls of anesthesia.
2. **The anesthetist should assemble all the necessary equipment and be prepared to induce anesthesia at least 15 minutes before the scheduled time of operation.**	Induction of anesthesia may be prolonged as a result of technical difficulties, slow action of drugs or other allowable delays, thus interfering with the progress of the surgical team.
3. The anesthetist should verify the	In large institutions confusion may

TABLE I

General Properties and Characteristics of Currently Employed Anesthetic Drugs

Name	Chemical Name	Formula	Description	B.P. or M.P.	S.G.	Stability	Preservative	Packaged	Accepted	Remarks
Ether	Diethyl oxide	C_2H_5 O C_2H_5	Colorless mobile inflammable liquid with pungent odor.	B.P. 36–37° C.	Liq. .718 at 15° C Vap. 2.6	Oxidized by air or oxygen light or heat to peroxides.	Copper or iron.	Dark bottles, cans.	U.S.P.	Contains up to 4% alcohol from manufacturing process.
Vinethene	Vinyl oxide	C_2H_3 O C_2H_3	Colorless inflammable liquid with garlic like odor.	B.P. 28–29° C.	Liq. .77 at 20° C. Vap. 2.2	Polymerizes to resins. Decomposed by acids.	Basic substances, amines or other.	Dark bottles.	U.S.P.	Contains 4% added alcohol to elevate boiling point.
Chloroform	Trichlormethane	$CHCl_3$	Sweet pungent liquid yielding heavy vapor.	B.P. 60–61° C.	Vap. 4.12	Oxidized by air, oxygen, light or heat.	Ethyl alcohol.	Dark bottles.	U.S.P.	Contains added alcohol to act as a preservative.
Ethyl chloride	Monochlorethane	C_2H_5Cl	Colorless mobile highly volatile liquid.	B.P. 12.5–15° C.	Liq. .921 at 20° C. Vap. 2.28	Hydrolized to alcohol and hydrochloric acid.	None added.	Dark glass or metal amplon.	U.S.P.	Contains alcohol from manufacturing process.
Trilene	Trichlorethylene	C_2HCl_3	Sweet pungent mobile liquid	B.P. −87° C.		Oxidized by air, oxygen, light, heat and soda lime	Thymol	Dark bottles	U.S.P.	
Paraldehyde	Polymer of acetaldehyde	$(CH_3CHO)_3$	Colorless mobile liquid with pungent clinging odor.	B.P. 121–122° C.	Liq. .999 at 20° C.	Converted to acetaldehyde. Very slowly decomposed by acids.	None added.	Dark bottles.	U.S.P.	May contain traces of acetaldehyde.
Amylene hydrate	Tertiary amyl alcohol	$C_5H_{11}—OH$	Colorless mobile liquid.	B.P. 98–100° C.		Stable.	None added.	Dark bottles.	U.S.P.	Used as solvent for tribromethanol to form avertin.
Trichlorethanol	1 Hydroxy 2 Trichorethane	CCl_3CH_2OH	Colorless liquid.	B.P. 151° C. at 751 mm. Hg.	Liq. 1.555 at 20° C.	Oxidized to aldehydes and hydrobromic acid. Decomposed by heat, light, air.	Keep cool, away from light.	Dark bottles.		Sparingly soluble in water, but will make a 3% solution at 37° C.
Tribromethanol	1 Hydroxy 2 Tribromethane	CBr_3CH_2OH	White powder, which sublimes with decomposition.	M.P 80° C.		Oxidizes to aldehydes and acids decomposed by heat, light, air.	Keep cool, away from light, heat, air.	Dark bottles.	U.S.P.	1 gram dissolves in ½ cc of anylene hydrate to form 1 cc. of avertin fluid.
Ethylene	Ethene	C_2H_4	Colorless gas with an etheral odor.	B.P. 103° C.	Vap. .97	Stable at ordinary conditions.	None added, keep in a cool place.	Compressed into a liquid and stored in steel cylinders.	U.S.P.	Carbon monoxide a possible impurity.
Cyclopropane	Trimethylene	C_3H_6	Colorless, sweet smelling gas.	B.P. −34° C.	Vap. 1.46	Stable at ordinary temperatures and pressures.	None added, keep in cool place.	Compressed into a liquid and stored in light metal cylinders.	U.S.P.	A polymer of propylene in presence of iron at 100° C. may be converted to propylene.
Nitrous oxide	Nitrogen monoxide	N_2O	Colorless, sweet smelling gas.	B.P. −89° C.	Vap. 1.54	Stable.	None added, keep in cool place	Compressed into a liquid and stored in heavy metal cylinders	U.S.P.	Noninflammable, but supports combustion