

MODERN BALANCED ANESTHESIA: A CONCEPT *

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APRIL, the month of showers, is mainly responsible for the flooding springtime rivers. Anesthesiology as a specialty perhaps may be said to be passing through its own particular month of April, wherein a torrent of new techniques and new agents is adding constantly to the roaring stream of technical details. The emphasis has been, and still is, upon the technical aspects of anesthetic administration. This is the natural, and even essential, necessity of any young and growing specialty. Yet the time must come when separation into isolated and restricted areas of drugs and techniques is supplanted by an urgently needed reintegration. The anesthesiologist needs to be an accomplished technician, of course; first, however, he must be a physician, in the broadest sense of that word.

It would appear that this cannot be accomplished best by the addition of more and more ancillary duties to the services presently rendered by the anesthesiologist, but rather by the inclusion of those services that are presently being rendered into the total practice of the profession of medicine. When a specialty becomes too enamored of its own finely drawn entities and techniques, there is grave danger that it will become split off from the great mass of knowledge that is medicine in general. The fruit cannot develop away from the vine, and without the adoption of a basic philosophy sympathetic to medicine as a whole, anesthesiology cannot long resist the temptations that would make of it work for mere technicians.

We wish to submit just such a basic philosophy, which we have chosen to call Modern Balanced Anesthesia. But it must be realized that anesthesia is a rapidly changing entity, and that what is modern balanced anesthesia today, may well be called by another name tomorrow. This is scarcely the final philosophy of anesthesia, nor even the penultimate along the road toward final definition. It is merely one group's attempt to reorientate thinking away from the technical details, which are admittedly of such vital importance, but which now must be accompanied by a more mature philosophy if the specialty is

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to achieve its real fulfillment. It may seem presumptive to some that we should embark upon such an undertaking, yet we do so without temerity, for this is a philosophy which has precipitated much acrimonious debate, and about which there exist multiple uncertainties that require elucidation.

THE PRIMARY CONSIDERATION

During the past decade or so, this term balanced anesthesia has undergone a slow evolution of meaning that apparently has not been fully appreciated by all those engaged in the surgical aspects of medical care. To many such, the term now denotes a complexity of anesthetic

ANOCI-ASSOCIATION

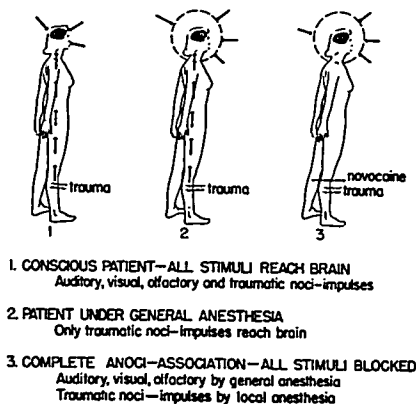


FIG. 1.

agents and techniques which serves only to render the administration of anesthesia more dangerous and more difficult than appears necessary for the accomplishment of mere surgical intervention. There is, today, a modicum of agitation for a return to the original agents, the simple techniques, and the "sound fundamental principles" of the anesthetic practices of former days. If there is an aura of validity about such arguments, there is also a jacksonian march of total misunderstanding, for if the object were merely to make anesthesia complicated on a technical basis, modern balanced anesthesia would long ago have become stultified and been abandoned. It has not been abandoned because it is a dynamic philosophy of anesthetic administration that has as its objective the eventual achievement of ideal anesthesia.

THE EVOLUTION OF THE TERM, BALANCED ANESTHESIA

From an historical viewpoint, the term, balanced anesthesia, probably may be said to have had its origins from the theory of anoci-association, propounded by the late George Crile, Senior, in 1911 (fig. 1). Reasoning along physiological lines, Crile argued that not only must the brain be protected against destructive psychic strain by the use of general anesthesia, but that local anesthesia must also be employed to exclude noxious impulses arising from the site of surgical interventions. He pointed out that although such double protection could be achieved by very deep general anesthesia produced with only one agent—such as chloroform or ether—the cost to the patient in terms of deranged metabolism would be too horrendous to be feasible. Lundy

BALANCED ANESTHESIA

LUNDY'S VERSION

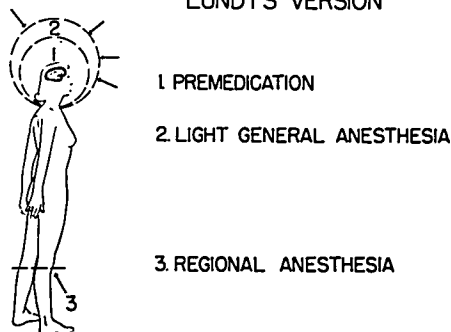


FIG. 2.

adopted a similar line of reasoning in 1926 when he coined the term "balanced anesthesia" (fig. 2), which he employed to designate the use of a combination of anesthetic drugs and methods so balanced that the burden of the relief of pain would be borne in part by the preliminary medication, in part by regional anesthesia, and in part by light general anesthesia. The introduction of cyclopropane in 1930, pentothal® in 1934, and finally curare in 1942, led to the development of combined anesthesia (fig. 3), the immediate predecessor to modern balanced anesthesia. In combined anesthesia, minimal amounts of an hypnotic (pentothal), an analgesic (nitrous oxide, ethylene or light cyclopropane), and a muscle relaxant (curare, or one of its numerous analogues) are used in combination to produce adequate conditions for surgery without recourse to deep general anesthesia and its attendant physio-

logical disturbances. Finally, the modern use of the term balanced anesthesia came to imply the production of anesthesia by the use of several different agents, often administered by several different routes, which might then be detoxified and excreted in several different ways. The logic claimed for such combinations of drugs and techniques was the fact that all anesthetic drugs are potentially toxic; if given in excess, they are quite capable of lethal action; but even if administered skillfully, yet in sufficient dosage to produce true surgical anesthesia, such drugs may precipitate unwarranted alterations in body metabolism. It was thought that by combining several drugs, each being employed in minimal amount, the desired state of anesthesia might be produced with the least possible disturbance of physiological function, and with the smallest possible burden upon each of the different mechanisms of excretion or detoxification.

COMBINED ANESTHESIA

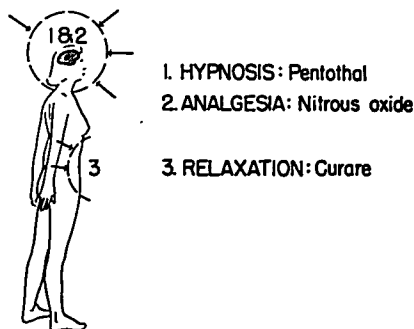


FIG. 3.

In this manner was the term, modern balanced anesthesia, evolved. What now of the evolution of the concept implied by that term?

THE EVOLUTION OF THE MODERN CONCEPT OF BALANCED ANESTHESIA

A few decades ago, surgery was a dangerous process from the patient's standpoint, and like marriage—which it so little simulates—was not to be entered into unadvisedly or lightly. The great danger was shock, both hemorrhagic and anesthetic, and if the patient came off the operating table not too depressed, not too cyanotic, and not too clammy to the touch, the operation was deemed a success and the anesthesia at least adequate, if not indeed thoroughly satisfactory. The solution of these problems of hemorrhagic and anesthetic shock, by the replace-

ment of blood and fluid on the one hand, and the more skillful administration of lighter anesthesia with less shocking drugs on the other hand, served to raise the practice of surgery from an action of last resort to an elective procedure.

The second period in the evolution of the concept of modern balanced anesthesia was concerned with not merely getting the patient off the table alive and with a chance for survival, but with getting the patient off the table alive and with a certainty for survival. The great problems solved during this period were those of adequate oxygenation, the elimination of waste products, particularly carbon dioxide, and the achievement of muscle relaxation in light planes of anesthesia by the use of curare and the myriad analogues which have followed the introduction of that drug.

Finally, the present period in the evolution of this concept of modern balanced anesthesia has been concerned with not merely getting the

THE FUNDAMENTAL TENETS OF BALANCED ANESTHESIA

*1. THE PATIENT SHOULD UNDERGO SURGERY
SAFELY AND PLEASANTLY*

*2. THE SURGEON'S WORK SHOULD BE MADE
EXPEDITIOUS*

*3. PROMPT RETURN TO PRE-OPERATIVE
PHYSIOLOGICAL STATUS QUO*

TABLE 1.

patient off the table alive, with a certainty of survival, but also getting the patient off the table in as good, if not indeed better, physiological balance as that which existed prior to operation. Thus, attention has been directed toward disturbances of fluid, electrolyte and acid-base balance, and those agents and techniques that might jeopardize such equilibriums are avoided. Attention has been directed also toward the control of excessive and undesirable reflex activity, both during and after operation. Finally, attention has been directed toward the rapid and uneventful postoperative recovery of the individual patient; a short, pleasant, safe convalescence, with all that this implies of the entire anesthetic management.

The modern concept of balanced anesthesia, therefore, carries a connotation far broader than the denotation of Crile's original hypothesis, Lundy's original terminology, or combined anesthesia's novel combina-

tion of drugs. It encompasses, in fact, the entire gamut of modern anesthesiological practice; and it may entail the use of a dozen different agents and techniques, or only one. Thus the tools of modern balanced anesthesia must include all those anesthetic techniques and methods which may be necessary for the accomplishment of the objectives that modern balanced anesthesia has as its basic three fundamental tenets: (1) that the patient should undergo surgical intervention as safely and as pleasantly as is possible; (2) that the surgeon's work should be made as expeditious as is possible, and (3) when surgical intervention has been terminated, that the patient should return to a normal physiological *status quo* as rapidly and as pleasantly as is possible (table 1). The transfer of these fundamental tenets from mere philosophical rumination into practical, clinical considerations now permits the enu-

THE REQUIREMENTS OF BALANCED ANESTHESIA

HYPNOSIS

ANALGESIA

OXYGENATION

REMOVAL OF WASTE PRODUCTS $\left\{ \begin{array}{l} \text{CO}_2 \\ \text{HEAT} \end{array} \right.$

MUSCLE RELAXATION

CONTROL REFLEX ACTIVITY

*MAINTENANCE CIRCULATORY, ACID BASE,
ELECTROLYTE EQUILIBRIUM*

OPTIMAL WORKING CONDITIONS

*PROMPT RETURN PHYSIOLOGICAL STATUS
QUO*

TABLE 2.

meration of the requirements of modern balanced anesthesia (table 2): (1) adequate oxygenation; (2) hypnosis; (3) analgesia; (4) muscular relaxation; (5) the control of undesirable reflex activity; (6) the removal of waste products, particularly heat and carbon dioxide; (7) the maintenance of circulatory efficiency, electrolyte balance and acid-base equilibrium.

THE CLINICAL IMPLICATIONS OF MODERN BALANCED ANESTHESIA

The clinical implications of the concept of modern balanced anesthesia can be demonstrated most succinctly perhaps by an actual case in point (fig. 4). In this instance, radical neck dissection was contem-

mon carotid and internal jugular ligation, proceeded with alacrity. A slow infusion of blood was started, as a prophylactic measure against inadvertent hemorrhage. Electrocardiographic tracings during intubation (fig. 5) failed to reveal any arrhythmias, but some forty minutes later, during dissection in the region of the common carotid artery, a disturbance of rhythm of ventricular origin was recorded. An intravenous injection of 50 mg. of pronestyl® failed to alter the arrhythmia, but a further 50 mg. injection one half minute later abolished the abnormal rhythm within a matter of seconds. The surgical procedure was completed without further incident: the blood pressure climbed slowly to normal levels, and at the time of extubation the patient was awake on the operating table.

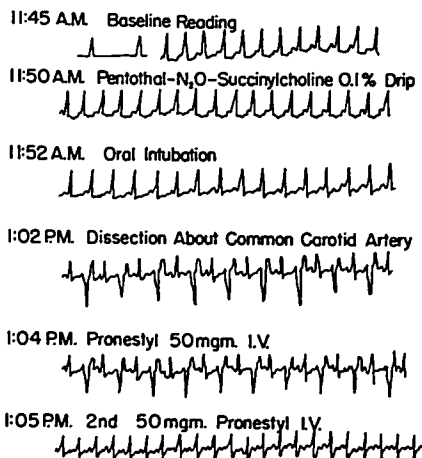


FIG. 5.

There is little doubt that this method of anesthetic management was complex, but it served to provide and maintain conditions that would not have been possible of achievement with simpler approaches. The technique outlined, performed only for the technique's sake, surely would represent merely anesthesiological acrobatics; and if this were the be-all and the end-all of modern balanced anesthesia, it would be a sorry philosophical approach to the treatment of the sick, indeed. But the touchstone of modern balanced anesthesia resides neither in a multiplicity of agents nor in a complexity of techniques. The next example (fig. 6) represents the concept of modern balanced anesthesia as truly as any multiple combination of drugs and techniques. In this

instance, the patient was administered an analgesic concentration of 50 per cent nitrous oxide with each uterine contraction and this intermittent administration was employed throughout the first stage of labor. During actual delivery, which was spontaneous in this multipara, nitrous oxide was administered continuously by the semiclosed technique until the termination of the third stage of labor with the expulsion of the placenta. Here was no hodge-podge of techniques, no panorama of drugs crossing the clinical scene, no arraignment of

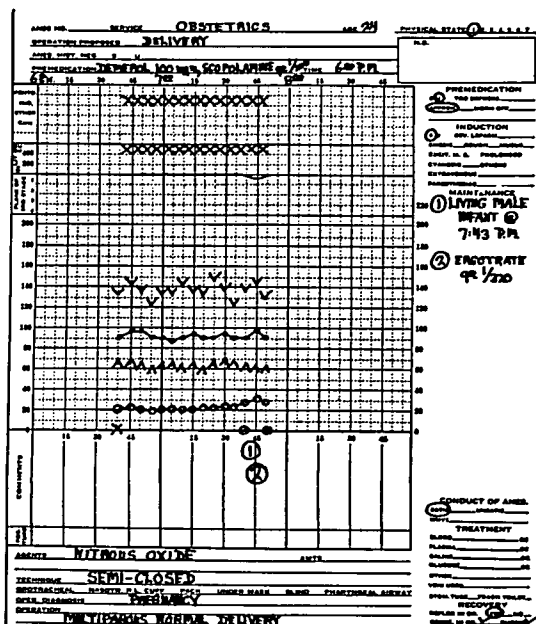


FIG. 6.

the newest in anesthesiology—yet here, indeed, was modern balanced anesthesia.

One may ponder at this juncture, quite justifiably, the exact nature of modern balanced anesthesia. If this latter example is truly modern balanced anesthesia, then a multiplicity of agents and techniques must be only an occasionally necessary means—not the ends—of this concept. If the mere concoction of a complex anesthetic "cocktail" in no way

represents modern balanced anesthesia, what then is the end result sought? Perhaps these two brief examples of the clinical uses of the method will be regarded as extreme—they are, and purposely so. Anesthesia for the simple multiparous spontaneous delivery required only nitrous oxide analgesia and light hypnosis to provide the patient with a pleasant and safe anesthetic state, from which she returned rapidly and comfortably, after the surgeon had performed his work

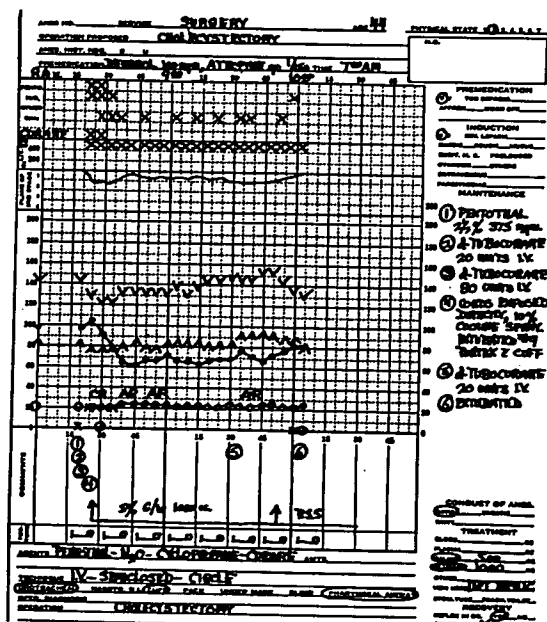


FIG. 7.

expeditiously under adequate conditions for operation. On the other hand, the extensive radical neck dissection required ten different agents and six different techniques for the accomplishment of the objectives of the anesthesia. Yet a consideration of these two extremes will lead to the basic philosophy we seek, for these two examples share one characteristic in common, one characteristic that renders them both prime illustrations of modern balanced anesthesia: they both accomplish adequately the purposes of anesthesia for the job at hand. Here, then, is

the definition of modern balanced anesthesia: the adequate accomplishment of the objectives of anesthesia for the job at hand.

THE CLINICAL APPLICATIONS OF MODERN BALANCED ANESTHESIA

Further illustrations of the usages of modern balanced anesthesia in clinical practice will not, perhaps, be misplaced at this time.

A 44 year old housewife was scheduled to undergo cholecystectomy (fig. 7). Premedicants were demerol and atropine, and the induction was begun with intermittent intravenous doses of pentothal followed by nitrous oxide by the semiclosed technique. A test dose of 20 units of d-tubocurarine was administered, and following the evaluation of the effects of this dose, a further dose of 80 units of the drug was injected. Apnea supervened, and following hyperventilation of the patient with oxygen, the glottis was exposed by direct laryngoscopy, the vocal cords were sprayed with 10 per cent cocaine, and endotracheal intubation was performed. Controlled respirations were employed until the return of spontaneous respirations, and then adequate ventilation was maintained by assisted respirations. Operation proceeded with dispatch, and at the end of an hour the surgeons were ready for peritoneal closure. A further 20 units of d-tubocurarine was administered to facilitate this maneuver, and respirations were again assisted. The patient was reacting, and almost conscious, at the time of extubation. This case illustrates modern balanced anesthesia that is closely related to and greatly resembles combined anesthesia.

In another instance (fig. 8), repair of an umbilical hernia was proposed on a 3½ year old child. Following premedication with morphine and scopolamine, 5 per cent pentothal (in a dosage of 10 mg. per pound) was administered rectally. The child was lethargic and drowsy upon arrival in the operating room, and induction was achieved with nitrous oxide administered by a nonbreathing mask. Then open drop vine-thene® and ether were employed to carry the anesthesia to the upper third plane of the third stage. At this point, intubation was performed under direct vision, and a number 3 Portex endotracheal tube was inserted and attached to a nonbreathing valve. Anesthesia was maintained at the level of the first plane with a nitrous oxide-oxygen-ether mixture administered in this manner, and proceeded uneventfully to the time of extubation at the end of the surgical procedure. The record of the pulse and respirations during the course of this operation indicates well the wisdom of the choice of this complex anesthetic procedure.

An extremely poor risk patient, 72 years of age, markedly cachectic, and with a history of a previous coronary occlusion, was scheduled for exploratory laparotomy and probable gastrectomy (fig. 9). Premedication consisted of 50 mg. of demerol and atropine, grain ½₂₀₀, but an hour later when the patient was brought to the operating room a further 25 mg. of demerol was administered intravenously because of persisting

apprehension. Anesthesia was induced with but 75 mg. of pentothal, and maintained with nitrous oxide-oxygen. Bilateral intercostal blocks were performed, from the seventh to the eleventh thoracic segment in the midaxillary line, employing 2 cc. of efocaine in each intercostal space in order to provide both prolonged conduction anesthesia, as well as postoperative pain control. Light cyclopropane anesthesia, just sufficient to attain stage 3, was administered, and the operation was begun. After about an hour and a half of surgery, profound traction on the

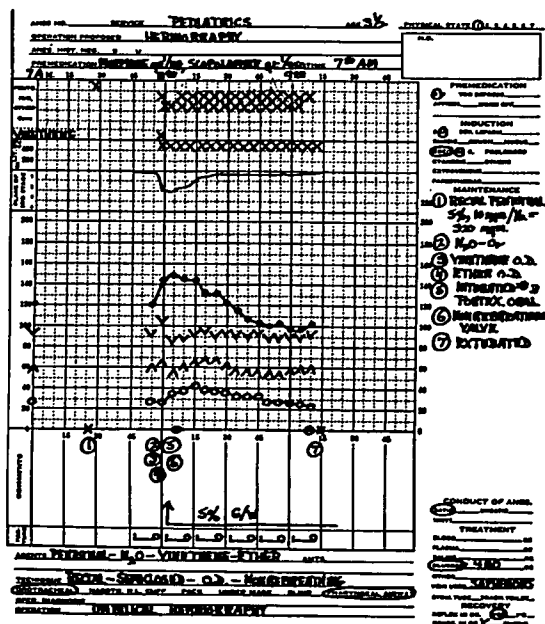


FIG. 8.

stomach produced a severe laryngospasm; 10 mg. of succinylcholine was injected intravenously and sufficed to overcome the spasm and induce apnea. Respirations were therefore controlled, and the opportunity afforded by the apnea was utilized to perform intubation under direct vision, since it was deemed imperative to avoid the occurrence of any further degree of hypoxia. Operation then was continued and completed without further incidence. The techniques and anesthetic management depicted in this instance are strikingly similar to the bal-

sufficient cyclopropane was administered to maintain light surgical anesthesia. Throughout the course of operation, the infusion rate was varied according to the necessities of the surgical exigencies of the moment, so that ideal operating conditions were provided at all times. At the completion of operation, the patient was awake on the operating table. This example perhaps approximates more closely than any of the others the type of anesthetic management sought for in the objectives of modern balanced anesthesia.

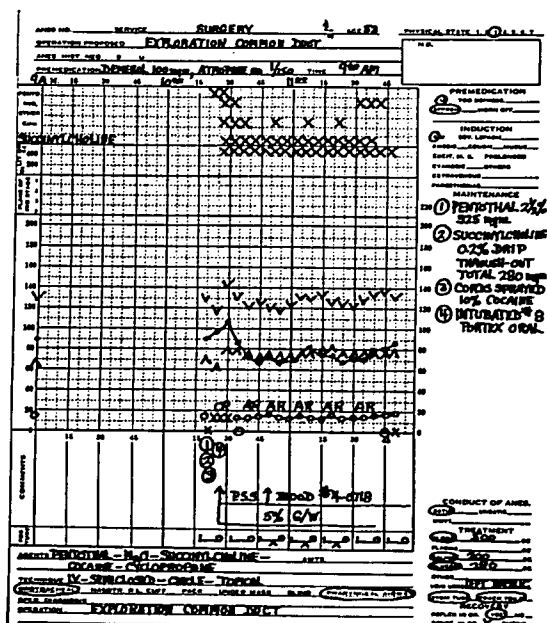


FIG. 10.

THE PHARMACOLOGICAL PURISTS AND THE TECHNICAL SIMPLISTS

Most of us practice modern balanced anesthesia to a greater or lesser degree. If the concept is not without its disciples and prophets, it is also not without its detractors. The opposition is based upon two facts inherent in the clinical application of the concept; first, that it may require the judicious administration of several drugs, and, second, that it may require a complexity and variety of techniques. Both of

these facts are undubitably true, but the proposition that they constitute logical objections to the employment of modern balanced anesthesia is not quite valid.

The "pharmacological purists" object to modern balanced anesthesia on the basis that it represents merely a present-day version of the old-time shotgun prescription—and therein lies the fallacy of the argument. The old-time shotgun prescription threw in a pinch of most of the then-current pharmacopia, in the hope that whatever the unknown diagnosis might in truth be, one of the many ingredients of the prescription would suffice to halt the disease process. When a number of drugs are employed in modern balanced anesthesia, they are not employed on this basis. It would be a sin of purgatorial levels to administer highly toxic and potentially lethal drugs carelessly and lightly, with no consideration as to their pharmacological effects, or even as to whether such pharmacological effects were either desirable or necessary. That drug, or those drugs, which are necessary to achieve the purposes of anesthesia for the job at hand, are administered—no more, and for a certainty, no less. Clinical pharmacology can only be practiced by employing each drug for a specific effect, in the quantity necessary to achieve that effect.

It is at least as great a sin to expect that any single drug can, pharmacologically and within safe limits, perform all the tasks demanded of a modern anesthesia. Driven beyond the bounds of physiological rectitude into the bleak canyons of toxicological activity, almost any substance can achieve anesthesia of a sort. Water, for instance, in studendous quantities, can produce absolutely total anesthesia. Yet this can scarcely be classified as a triumph for water, and surely does not warrant the selection of that substance as the anesthesia of choice for all cases. It would be exceedingly convenient if there were a single agent capable of providing all of the characteristics demanded of anesthesia today; the fact remains that there is not. It is, therefore, completely impossible to practice intelligent clinical pharmacology with only one drug—it was tried in the Middle Ages with as many as four, and failed miserably.

The "technical simplists," the other great group who, with the purists, constitute the opposition to modern balanced anesthesia, object on the basis that such anesthesia is often complex, and that the complex in medicine is often more dangerous in the hands of the inexperienced and the unknowing than is the simple. This is patently true; but it is scarcely an argument against the concept of modern balanced anesthesia. It is an argument, and good one, against the inexperienced and the unknowing as the purveyors of anesthesia in any form. Simplicity is certainly the ultimate goal to be sought, but progress must consist of doing more for the patient, not doing less merely for the sake of simplicity. Simplicity is a luxury in medicine, achieved only after great advancements are consolidated. It is not an end in itself, but the

perfecting of ends already obtained. It will come to anesthesia in time, but the specialty has not yet advanced to that stage of maturity at which it may indulge in the luxury of simplification.

CONCLUSIONS

Finally, what is to be the future of such a philosophy as that herein presented? It is evident that the agents, the techniques, and the clinical requirements of modern balanced anesthesia will disappear as advancing knowledge replaces them with other agents, other techniques, and other clinical requirements. But it seems clear that the basic philosophy—the adequate accomplishment of the purposes of anesthesia for the job at hand—is here to stay. This philosophy, or some other as yet unexpounded, is necessary to effect the reintegration of anesthesiology into the profession of medicine. As a philosophy, it is quite obviously far removed from perfection, but at least it boasts the realization that anesthesiology has passed from the realm of the purely technical in its simplest meaning to that of the professional in its fullest significance.

This, then, is modern balanced anesthesia.