

RELAXATION: A MEDITATIVE ESSAY

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DESPITE the peaceful significance of this word, probably no subject has ever given rise to more bitter controversy between surgeons and anesthesiologists. Since surgeons, in the main, know little of the detail of anesthesia and its stages, and since anesthesiologists rarely have much first-hand experience of operating conditions, and seem therefore unable to sympathize with the surgeon's difficulties, it seems worth while to analyze the factors which are summed up in the word "relaxation."

A surgeon performing an operation within the abdominal cavity seeks fulfilment of the following conditions as far as may be expedient: complete muscular flaccidity, complete peritoneal flaccidity, minimal respiratory movements, and contracted viscera which will fall idly back into the abdomen when the walls are lifted. There are certain objections to the production of this state of affairs from the viewpoint of the patient and that of the anesthetist. Such conditions may be provided comparatively easily for lower quadrant operations, with more difficulty for mid-abdominal sections, and with most difficulty for procedures involving structures in the epigastric region. In this essay I have chiefly in mind the upper abdominal procedures such as gastrectomy, cholecystectomy, and splenectomy.

It must be explained that my early training was obtained in a country where most surgeons demand a greater degree of flaccidity than is usually considered adequate in the United States; and in an institution noted for the technical dexterity of its surgeons. Once provided with the above conditions they usually performed cholecystectomy within thirty minutes and gastrectomy within sixty minutes. The expression "deep ether anesthesia" meant, to us, the very shallow, rapid, panting respiration, widely dilated pupils not reacting to light, and dry cornea, usually described by textbooks as the "stage of overdose"; and it is in this sense that the term is used in this essay.

Such utter flaccidity both of musculature and peritoneum can, in my view, only be procured safely and consistently with ether as the anesthetic agent; and this only at a depth of anesthesia approximating the middle of the fourth plane. At such a depth, respiratory movement is so much impaired that a considerable degree of oxygen want will be present unless an excess of oxygen is added to the inspired atmosphere, and, even if this be done, anoxia may occur in the cells of the central nervous system. Further, under these conditions a considerable accumulation of carbon dioxide must occur in the "dead space" of the lungs. This is the chief objection to the method. Nevertheless ether, administered by the "open" or "semi-open" technique on a gauze mask and

with an excess of oxygen, does very nearly approach the surgeon's ideal of operating conditions. The safety of this agent is proverbial, and it is capable of producing these conditions in every patient, given sufficient skill in its administration.

When ether is administered by the "semi-closed" technique following a nitrous oxide induction, full muscular and peritoneal relaxation are easily attained. It is usually more difficult, however, to produce the same depth of anesthesia as by "semi-open" methods, and therefore, the respiratory movements are greater in volume. For reasons presently to be discussed, the hollow viscera tend to be distended when any of the gaseous agents are in use, and this is the chief disadvantage of the method.

Of chloroform I personally have no experience in this type of work, but I gather from those who have used it extensively that it will produce, in the lower second plane, conditions comparable to those seen with ether in the lower fourth plane, with the difference that respiration is much quieter. It is for these reasons that our forbears regarded its use as indicated for abdominal procedures. The regulations of one ancient teaching hospital in England require that when chloroform is used the indication for its use must be stated. In the anesthetic record books, which merely state that a certain agent was administered to a certain patient, on a certain day, for a certain operation, I have often seen: "Anesthetic: Chloroform. Reason: Abdominal Operation." In this particular institution this was the rule in the early years of this century, and the custom was not forsaken until "open ether" became popular in about 1910.

Cyclopropane is a baffling agent to evaluate from the standpoint of relaxation. It is probably the most difficult inhalation agent to administer with success. While in many ways it resembles chloroform, it differs markedly from it in the degree of flaccidity produced at a given plane of anesthesia in the muscles of the abdominal wall. With cyclopropane, as with ether, if reflex muscular spasm is to be avoided on surgical stimulus, the patient must be deeply anesthetized. Cyclopropane is not a respiratory stimulant in light anesthesia and therefore there is a tendency for the respiration to fail before sufficient depth is achieved to produce relaxation. This difficulty can only be overcome by the use of artificial means to maintain respiratory movement when spontaneous respiration has failed. But even when this is done, and deep anesthesia is achieved, the operating conditions are lacking in some respects. With cyclopropane, *muscular* flaccidity is rarely the equal of that seen with ether, although the peritoneal relaxation may at times exceed it. It appears to be a characteristic of the agent in that it often produces a state of affairs in which a comparatively rigid set of muscles overlies a surprisingly slack peritoneum. If, in an endeavor to secure complete flaccidity of all the structures comprising the abdominal wall the concentration of cyclopropane is increased, arrhyth-

mia is often encountered. In the present state of our knowledge it is not possible to evaluate the exact importance of this phenomenon, which often follows oxygen want consequent upon either depression of minute-volume or reflex closure of the glottis. Until further work elucidates the exact significance of these disorders of rate and rhythm, only the most experienced workers can afford to disregard them. They are much more frequently seen with cyclopropane than with ether. In the deeply etherized patient the abdominal wall can be picked up and held some three inches clear of the abdominal contents, which fall back, contracted, into the cavity. This state of affairs is rarely seen with cyclopropane for, however relaxed the patient, the loops of intestine are always comparatively large, and protrude through the peritoneum when it is opened. Surgeons accustomed to the operating conditions under deep ether anesthesia immediately protest at this point that "the guts are bulging out." It has been shown that the gaseous anesthetics are excreted, in small but definite quantities, into the lumen of the gut; and it may be presumed that herein lies the explanation of this phenomenon, which is equally marked when mixtures of nitrous oxide and ether are in use. On the other hand, it is probably true that the respiratory movements, which can be a source of annoyance to the surgeon, are more easily subdued when cyclopropane is in use. Deep ether anesthesia involves rapid panting respirations which can be very irritating, and these at best can only be minimized by keeping the plane of anesthesia so deep as to reduce the movement to an absolute minimum, unless some form of physiological apnea is produced.

Another possibility is the "high spinal." To be effective for operations above the umbilicus the subdural block must reach as high as the fourth dorsal segment. Even when this height is achieved the analgesia still does not affect the autonomic innervation of the upper part of the alimentary tract, and supplementary infiltration is usually necessary. Such a high spinal block involves a great strain on the circulatory system of the patient, and probably a longer period of paralysis of the intercostal muscles than results from the administration of an inhalation anesthetic. Even though the analgesia is perfect, most patients find it a severe emotional strain to remain conscious during operation, and suffer considerable discomfort from the abdominal manipulation involved. The surgeons I have above referred to, who had been used to working all their lives with patients deeply anesthetized with ether, were usually disappointed with the relaxation of muscles provided by spinal analgesia, for there is a definite difference between the muscular quiescence which obtains during spinal analgesia and the complete flaccidity or atonia seen when the tissues are saturated by ether.

The technique of administration of the anesthetic plays an important role in determining the extent to which ideal operating conditions can be produced, whatever the agent. Either oxygen want or carbon dioxide in excess can cause an artificial muscular rigidity. Any interfer-

ence with the patency of the patient's airway is the most usual way in which these conditions occur. Transitory obstruction is commonly seen in the edentulous patient whose tongue tends to become wedged between the lips during the movements of the second stage. Prophylaxis is always better than treatment; and this state of affairs can usually be avoided by placing a circular dental prop between the gums before beginning the induction. Obstruction above the level of the glottis is easily remedied in the third stage of anesthesia by means of an artificial pharyngeal airway.

Obstruction occasioned by the closure of the glottic opening, however, is a very different matter. Laryngeal spasm is often initiated by the presence of mucus in the pharynx which irritates the cords in light anesthesia. This can usually be prevented by suitable preanesthetic medication, and above all, by smooth induction. The latter will also obviate the variety of spasm which occurs as the result of the exhibition of too concentrated an anesthetic vapor, and is merely due to faulty technique. But reflex glottic spasm is most frequently occasioned by surgical stimuli in the abdomen, and results in a tightening up of all the structures, accompanied by an increase in respiratory effort. This situation constitutes a grave potential danger because it causes a complete respiratory obstruction which is extremely difficult to treat though easy to prevent; and it should not be permitted to occur. There are three methods by which laryngospasm may be prevented or treated. The first is anesthesia of such a depth as to abolish the reflex, which is one of the last to disappear. The second is local analgesia of the glottis by topical application. The third is endotracheal intubation. When spasm has once set in it is difficult to deepen the anesthetic because of the restriction of the airway. Deep anesthesia is therefore a successful prophylaxis, but a poor method of treatment. Local analgesia is satisfactory if efficiently applied through a laryngoscope; but I doubt the wisdom of paralyzing the cough reflex for some time to come in a patient who has had an upper abdominal intervention. I am firmly convinced that endotracheal intubation is the ideal prophylaxis against glottic spasm and I feel that its true place is as a preventative rather than as a palliative treatment after the damage has been done. Glottic spasm is unpredictable in its behavior and dangerous inasmuch as the anesthetist cannot control it; and therefore it should be made impossible as early in the course of the anesthesia as is practicable.

It is difficult to understand why "relaxation," judged by the criteria above enumerated, should always appear more satisfactory in a patient whose glottis has been intubated. Experience has convinced me that such is the case; to such an extent, in fact, that for years I have taught that complete relaxation of the abdomen cannot, except in the easiest cases, be obtained with any of the gaseous agents or nitrous oxide-ether mixtures, unless the patient is intubated. Perhaps it is because intubation makes for free breathing and so prevents the commonest cause of

oxygen want and an excess of carbon dioxide. Or perhaps it is that when the larynx cannot be closed the patient is unable to raise his intra-abdominal pressure by straining. Whatever the reason, I stand convinced that intubation is a *sine qua non* of efficient relaxation in the abdomen.

When the carbon dioxide absorption technique is in use, "quiescent" muscles (as opposed to "atonic" or "completely flaccid" muscles) are found in comparatively lighter anesthesia. On the other hand, the production of very deep anesthesia is a much slower and more difficult proceeding under these conditions. When once deep anesthesia has been reached, however, the absorption technique makes it possible to modify respiratory inconvenience to the surgeon by means of "controlled respiration." There is only one other way of doing this, and that is by exploiting the now almost obsolete technique of Meltzer and Auer and producing an acarbic apnea by the forcible insufflation of anesthetic gases. This achieves the same object by a totally different method. If, as it would seem, apnea, or something very close to it, materially facilitates the surgeon's work, then probably either technique is justifiable in these cases.

Quite apart from the operating conditions stands the fact that alone by one of these methods can carbon dioxide tensions be kept within normal bounds during very deep anesthesia, and controlled respiration would seem the more rational way of doing this. It still seems a moot point whether or not overdosage to the point of circulatory failure is a danger in practice if either of these techniques is used in very deep anesthesia. When a patient is in apnea it becomes very difficult to be certain of the plane of anesthesia. Since operating conditions are virtually identical in the third and fourth planes when a physiological apnea has been produced, there is the less need to risk disaster, and the patient can be spared unnecessarily deep anesthesia.

It is true that the exhibition of basal narcosis in some form can help in overcoming these difficulties. The various agents used for this purpose promote relaxation but also reduce respiratory volume. The latter attribute is a double-edged weapon because depression of respiration may in turn mean the inability of the anesthetist to cause sufficient of the inhalation agent to reach the alveoli and the blood to produce the deep anesthesia at which he aims.

Finally, some mention must be made of the respiratory complications which are among the most serious of upper abdominal surgery and which are responsible for a large proportion of postoperative deaths. The incidence of these appears to depend rather on the nature of the operation and the condition of the patient than on the anesthetic agent used. It has, however, been shown that their incidence is increased by the exhibition of basal narcosis. Many authorities have attributed them to the direct effects of the inhaled anesthetic vapors, and have advanced the view as an argument in favor of non-inhalation anesthesia in these

cases. My own experience, which is shared by better authorities, of using non-inhalation methods in the hope of minimizing respiratory complications has been uniformly disappointing. The use of any drug which produces respiratory depression is conducive to respiratory complications in the postoperative period, and this fact should, I believe, always be borne in mind. It is, however, my belief that the comfort of the patient deserves more consideration than it has heretofore been accorded. Most British anesthetists are agreed that the administration of ether in any form to a patient still conscious is so unpleasant as to be unjustifiable, especially since the great variety of alternatives available nowadays renders such techniques superfluous. In the main, patients seem to react towards the induction of anesthesia much as they do towards alcoholic excess: to the majority it is stimulating and not unduly unpleasant; to the minority it is an unpleasant ordeal under the best auspices and all but intolerable under others. A due sense of proportion should, I believe, be exercised, and the unfortunate minority should not be deprived of the consolation of a pleasant induction merely through fear of possible complications. Avertin and the barbiturates are most useful additions to our professional armamentarium yet I doubt the wisdom of using them consistently in upper abdominal cases.

These technical considerations, however, are only the dry bones of the subject of this essay. Both surgeons and anesthetists should have at least these objects in common: a real desire so to master the facts of their respective subjects that, by due co-operation and a sympathetic understanding of the problems of major abdominal surgery, they may eventually evolve methods known to produce the best results for the patient. It seems fundamental to me that the object of anesthesia is to enable surgical operations to be performed; and in the best interests of the patient the competence of the operation should be of the highest possible order. This is particularly true of abdominal surgery, where an operation of lesser skill may condemn the patient to much discomfort or disability. Abdominal surgery is a difficult and exacting pursuit in which results seem to turn largely on gentleness. It seems to be beyond argument that the more nearly are these conditions of absolute relaxation approached, the more atraumatic is the operative procedure likely to be. It is the common experience of anesthetists that the degree of postoperative upset in the patient is profoundly modified by the amount of handling of the viscera, the quantity of packing that has been used, and the amount of trauma to the recti and diaphragm from forcible retraction. Effective relaxation reduces these to a minimum—at the price of really deep anesthesia. This probably does the healthy patient little harm if it is not maintained for excessive lengths of time, and it is less damaging than the surgical trauma to which light anesthesia usually gives rise. If this be true, then it follows that the surgeon must choose between two alternatives: either he must learn to exploit ideal conditions to enable his work to be quickly and easily done,

or he must work deliberately at a much lighter plane of anesthesia and tolerate its disadvantages.

It is true both of surgeons and anesthetists that they chiefly "learn by trying." If an anesthetist does not from time to time experiment with new agents and methods he will cease to keep abreast of the advances of his subject. When he thus experiments he is unlikely to produce as efficient relaxation as he obtains by methods with which he is familiar. Since in the past the anesthetist has usually been dominated by his surgeon, he has found it expedient to do his very best and to risk no experiments when the surgeon himself is operating. The experimentation has usually been deferred until one of the surgeon's juniors—Residents, First Assistants, House Surgeons, or Interns—has been allowed to "finish the list." This means in practice that the unfortunate patient is not only subjected to the risks attendant upon inexperienced surgery, but also to the double risk of surgery under very difficult conditions. In our profession, as in most, there can be no argument with one's seniors; and since the anesthetist is usually senior to the younger surgeons, the latter are forced to learn under the most trying conditions. This is surely entirely wrong, both to the patient and to the surgeon. A man of many years' experience should be able to work under certain mechanical difficulties; but when a young man is just beginning to operate, an already difficult task should be made as easy as possible, both for the patient's sake, and for the surgeon's. Conversely, the experienced senior surgeon should be willing, from time to time, and provided he is aware of what is being done, to work under somewhat imperfect conditions in order that knowledge may advance.

If the recent events in the world of politics have any meaning, they should teach us afresh the truth of the saying that "two blacks don't make a white." This is equally true of surgery and anesthesia. For generations anesthetists have had to tolerate, for economic reasons, dogmatic interference from surgeons in their own province: only in recent years are surgeons coming to regard their anesthetist as a colleague and advisor. Surely our attitude should rather be: "tell me what conditions you need in order to do your work most effectively, and I will do my best to supply them"; and his reply should be to outline these conditions and to add "it is for you to decide how these things should be realized." Whenever an individual case presents unusual difficulties this should be the attitude of mind in which it should be approached by both parties.

Unpleasant operating conditions are often not apparent on inspection from the angle of view available to the anesthetist, and conversely a surgeon completely absorbed in a difficult operation may perhaps be forgiven if, in the heat of the moment, he is apt to attribute his mechanical difficulties to the shortcomings of his anesthetist. Mistakes will often be made in perfectly good faith by both parties; but they should be sufficiently honest to admit to those mistakes later, for strict

honesty is indeed the best policy in this issue. "Tout comprendre c'est tout pardonner," and for that reason it is essential that a surgeon should have had some first-hand experience in the administration of anesthetics, and that an anesthetist should have learnt by bitter experience what it means to wrestle with unrelaxed abdominal muscles.

Although it is scarcely a technical consideration, personal friendship between surgeon and anesthetist is probably the greatest help in realizing these ideals. Men only speak freely and honestly with those whom they like. When such an understanding becomes the rule then the word "relaxation" will cease to represent, surgically, a travesty of its true meaning.

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The Library and Museum of the American Society of Anesthetists is open daily from 9:00 A.M. to 5:00 P.M., Mondays through Fridays (holidays excepted), in Room 1503, 745 Fifth Avenue, New York City. For special appointments at other times, call Susquehanna 7-5411. It was established a few years ago for the benefit of all in the medical professions. It is also open to the lay public, but is especially for the use of physicians interested in anesthesia. Admission is free. Guests are requested to register.

There are many interesting items in the library collection of the American Society of Anesthetists which can be obtained for local exhibits by making arrangements with the Librarian. One such rare item is a copy of John Snow's first edition on "Ether." This copy was Snow's personal desk copy and was never bound. There are more than 500 items in the library including all the recent books and journals on anesthesia. The books cannot be borrowed except by members of the Society, but transcripts, photostats, and microfilm copies of certain rare books and articles may be obtained for personal use by writing to the Librarian. Books may also be obtained for scientific exhibits if the proper requirements are met.

The museum of the American Society of Anesthetists now occupies 5 large cases and 24 smaller cases. The accessions date from the beginning of modern anesthesia to the present time. Among the collection may be seen the original Boothby-Cotton gas ether machine, the first gas machine on the West Coast of the United States, an early American chloroform mask, a Morton inhaler, the first Furniss inhaler, the first cyclopropane gauge, the first American Avertin kit, and numerous other originals. For the February meeting of the American Society of Anesthetists the Library and Museum Committee expect to have ready a special display showing the development of the anesthetic mask. All anesthetists are urged to enlarge this growing collection by sending any material they may have to the Library-Museum Committee. If you are holding a special meeting on anesthesia at which exhibits are desired, assistance in preparing them may be obtained by writing to the Chairman of the Museum Committee.