THE PATTERN OF ANAESTHESIA

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RECENTLY a third-year medical student who had been assigned to us for teaching walked into our operating room and after watching several operations expressed the conclusion that there were no problems in connection with anaesthesia. He had seen patients easily and rapidly put to sleep, intubated without difficulty, their breathing taken over by an automatic ventilator, muscle relaxation provided as needed by succinylcholine drip, and at the end of the procedure escorted to the recovery room apparently none the worse for their adventure. His feeling was that since that is all there is to anaesthesia, the anaesthesiologist is making a fuss over nothing. Of course, our residents, as soon as they take on a few cases themselves, quickly realize that actually there are many problems and that anaesthesia can be terrifying. However, it is one of the curious results of skill and progress that a complicated procedure looks so easy to the spectator. I am sure a really skilful surgeon often evokes the same reaction in the mind of an inexperienced observer. When I started giving anaesthetics more than forty years ago I can assure you that the average procedure was not easy for the anaesthetist, or for the patient, and that it didn't even look easy to anyone. Inductions with open drop ether were often formidable battles.

It may be interesting to examine for a few moments what has happened to make the pattern of anaesthesia so different from what it used to be. What is the criterion of "good anaesthesia"? Surely it must be the measure of the speed and completeness of a patient's recovery. By this yardstick I think that all of us are satisfied that anaesthesia is better than it was thirty or forty years ago. What has happened to make it so?

It isn't just a change in anaesthetic agents. I used to use practically nothing but ether, and now I almost never use it. But I am willing to concede that those who do now use ether frequently and expertly can give good anaesthesia judged by even the most critical of modern standards. And, conversely, the agent which I still use most frequently, cyclopropane, can be given so badly that both the immediate and future recovery of the patient are in jeopardy. And this is true of almost all the many agents which we now have available. Good or bad anaesthesia is possible with all of them. What, then, is important?

It is difficult to determine relative degrees of importance between things which are really essential. Among the factors in anaesthesia which are now recognized as essentials I would list the following: (1) an unobstructed airway, (2) adequate ventilation, and (3) fluid and electrolyte balance. Perhaps you may say these items are so obvious that they must always have been

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part of the practice of anaesthesiology. I can assure you that this is not the case. In my early days the quality of the patient's snore was one of the signs of the depth of anaesthesia. In the hospital there were neither airways nor suction tubes, and I have seen many a patient settle slowly down into irreversible asphyxia just because there was no way to cope with the combination of deep anaesthesia, depressed respiration, and excessive secretions. Endotracheal tubes revolutionized the situation so far as a free airway is concerned, but they were long in coming into universal use, and for many years some leading anaesthesiologists as well as surgeons deprecated their use. The first paper I ever delivered at a medical meeting was in Boston in 1928, and the subject was "Intratracheal Ethylene Anaesthesia." Up to that time endotracheal technique was seldom used, and when it was used it was almost always by positive pressure one-way insufflation methods rather than by the inhalation to-and-fro technique which became possible only after really wide-bore endotracheal tubes had been developed. My paper in Boston was listened to politely enough but caused little comment because, believe it or not, at least 75% of the so-called anaesthesiologists in that audience had never passed an endotracheal tube. Well, times have changed. Now intubation and anaesthesia are almost synonymous terms and practice begins with the earliest days of resident training. Perhaps we intubate too often and too nonchalantly, but at least the principle of a free and unobstructed airway is firmly established as one of the essentials for good anaesthesia.

The principle of adequate pulmonary ventilation was much more slowly recognized, and even today I think its importance is not given proper emphasis by many experienced and qualified anaesthesiologists. Pulmonary ventilation consists in getting oxygen in to the blood properly, and in getting carbon dioxide out of the blood properly. It is just as simple as that. It has taken us a long time to realize all of its significance and its importance in relation to the recovery of the patient. The first half of the problem, getting oxygen in, is easy—a high oxygen atmosphere, a wide open airway, and good heart action will do the job in a sort of a way even without active respiration—but getting carbon dioxide out is another problem altogether. In former days we were inclined to let this matter take care of itself. We thought that if the patient was breathing at all we didn't need to worry about ventilation. Even our spinal patients we allowed to lie and, as it were, "wallow in their own excretion." (I can remember taping a wisp of absorbent cotton in front of a patient's nose, and if this were fluttering at all I didn't worry.) On re-reading the early papers of all of us who wrote about cyclopropane (including Ralph Waters), I can find very little discussion about ventilation—oxygenation yes, but ventilation no. For years I advocated the use of "Leech's pharyngeal bulb gasway" which made a nice closed circuit for cyclopropane anaesthesia provided the patient was breathing spontaneously—any positive pressure on the breathing bag would break the circuit. Today I wouldn't allow any anaesthesiologist on my service ever to give an anaesthetic in which he could not supplement spontaneous respiration by positive pressure artificial ventilation. The reason for this changed concept is our conviction that any increase of carbon dioxide above normal alveolar levels is harmful, and that adequate ventilation at all times is the only way to get rid of it.

I suppose that the principal factor which has brought about a realization of the deleterious effects of retained carbon dioxide is the advent of muscle relaxants and other drugs which depress respiration. In the days of open ether anaesthesia our patients used to gurgle and choke, and snore and vomit, but they seldom stopped breathing before they were dead. Now, on top of a preoperative hypnotic we pile a pentothal induction, anaesthesia with such non-stimulating agents as cyclopropane, and then one or another of the muscle relaxants. I am not decrying this practice—in fact I advocate it—but it does mean that the responsibility for respiration and ventilation is squarely on the shoulders of the anaesthesiologist. John Gillies has included apnoea as one of the “physiological trespasses” intentionally perpetrated by the modern anaesthesiologist. I agree with him entirely that this is, generally speaking, both justified and advantageous to the patient, provided the anaesthesiologist does what he has to do—that is, take over from the patient the function of ventilation. I am afraid this is not always being done. As I look around in operating rooms in various places, in my own city as well as in other cities, and sometimes even in my own hospital, I see patients who are apnoeic, and who are certainly not being adequately ventilated. So far as I am concerned the theory of the superiority of the “educated hand” of the anaesthesiologist as a perfect controller of respiration is nonsense. The “educated hand” gets tired too easily, or gets interested in other duties, or has to stop to write up the chart. If we are going to control respiration during anaesthesia (as I think we should) there are two essential pieces of equipment we should have, no matter what agent is being used—a good mechanical ventilator (of which there are now many on the market) and a good, properly functioning carbon dioxide absorber (of which there are also now several available). Because of the importance of carbon dioxide elimination in major and prolonged surgery I believe it is not only justified, but almost imperative, purposely to render the patient apnoeic, and to take over respiration for him by means of a mechanical ventilator. I don’t see any justification for the belief, which some still have and which I held for a very long time, that even inadequate spontaneous respiration is better than any kind of artificial respiration—and I can’t see that the difficult technique of trying to assist depressed spontaneous respiration has any advantage over much simpler and surer complete control of respiration. It is easier for us just to take over the full responsibility for the patient’s breathing, and to make sure that we are efficiently carrying out for him the two functions of respiration, putting oxygen in and getting carbon dioxide out. This brings up the questions of if, when, and how the patient will begin to breathe again spontaneously. I admit there is a danger that apnoea may persist after a long operation is finished and we want to get the patient out of the operating room, turn him over to the recovery room nurses, and get to our coffee and cigarettes. It is our duty, however, to get this patient out of his apnoea, just as it was our duty to put him into it, and this poses problems which sometimes take time and skill and judgment. The apnoea which follows long-continued artificial ventilation is often not simple, but is made up of many factors. If we have been sensibly observant during the course of the anaesthetic, this apnoea is not often due to an overdose of relaxant drugs. It is due to a combination of drugs plus the

effects of mechanical ventilation and often hyperventilation, and even after the drugs have lost their depressing effect it takes time for the respiratory centre to remember what it is supposed to do. Sometimes we can help set it going by pulling a trigger, such as an adequate intravenous dose of Coramine. In any case it is the duty of the anaesthesiologist to make sure that the patient is breathing really effectively before he leaves him, and this is one place where I think too many of us are failing in our responsibility. Effective breathing doesn't mean just taking an occasional breath. Sometimes after anaesthesia the patient takes a long time to re-establish proper ventilation, and if we are not with him and instantly ready to support inadequate ventilation he may get a very poor start toward recovery. Endotracheal tubes are often removed far too soon. This is the patient's life line; it is easy to ventilate him when the tube is in place and often frustratingly difficult after it is removed.

The maintenance of good ventilation is, therefore, one of the mainstays of the pattern of modern anaesthesia. Because of our special knowledge in this field we are being called upon to help out in therapeutic problems which seem far removed from traditional anaesthesiology. Intensive care units are being established in more and more hospitals to continue the work of the recovery rooms, and I am sure that anaesthesiologists will be expected to shoulder many of the problems of caring for all sorts of patients with defective or obstructed respiration. I don't know where all this will lead to, but I think it is good for us to have this opportunity to demonstrate what good respiratory ventilation can do for a patient, whether he is suffering from pneumonia or a crushed chest, or barbiturate poisoning or some neurological disease.

The third indispensable support for my pattern of anaesthesia is fluid and electrolyte balance. Here I'm sure I don't need to say much and I haven't anything new to offer. Our practice today is far removed from the saline hypodermoclysis and rectal infusions which were the only routine means of supplying parenteral fluids to dehydrated patients forty years ago. I hope, however, that the anaesthesiologist won't become too nonchalant about the kinds and the quantities of fluids he pours into people's veins. It is comforting, of course, to have a vein open for emergency use during anaesthesia, and venapuncture is usually justified. But I can't help feeling irritated when I see residents and young anaesthesiologists so hidebound by routine that they set up intravenous drips for every case no matter how minor the operation may be. Veins on the back of the hand seem to provide an irresistible attraction, and many a patient goes home with a quite unnecessary haematoma to remind him of the great advances of modern anaesthesia. However, too often surgeons present us with cases for major operations that are quite improperly prepared—dehydrated, acidotic, with low blood volume or some other metabolic impairment. The anaesthesiologist must act in the patient's interest as a watchman to prevent such patients from getting in to the operating room before they are in better condition. Sometimes we just have to be ruthless. We have most trouble with otolaryngologists, gynaecologists, ophthalmologists, and urologists who seem to be so intent on their particular surgical problem that they can forget all the rest of the poor unfortunate body which is attached to an eye, an ear, or a prostate.

Blood transfusions save lives and I would hate to go back to the frustrations and tragedies of the pretransfusion era in which I started. Nevertheless, there is no doubt that many transfusions are given unnecessarily and without proper thought as to the balance between risk and benefit. Occasionally it is a good thing for us to run across a case which forcibly reminds us that even major surgery can be safely performed without blood transfusion. So fluid balance problems will always be with us—the important thing is to remember they are there, to try to understand the basic mechanisms involved, and to think individually regarding the particular patient in our hands.

I often regret that nowadays in my hospital and in many of our hospitals the practice of spinal anaesthesia and of regional block anaesthesia is gradually disappearing. It is a vicious circle in that our residents don't get enough experience ever to become expert in these techniques, and because they are not expert, surgeons and patients don't like them to practise. Because patients can now be put to sleep so comfortably and rapidly, general anaesthesia is what most people prefer, and I can see their point of view. However, I can think of no technique more satisfying for obstetrical delivery than small-dose spinal anaesthesia, provided it is carried out rapidly and skilfully. Nevertheless, in recent years the incidence of obstetrical spinal anaesthesia in our hospital has dropped from over 60% to less than 5%. Fashions change in anaesthesia with no more reason than they do in the length of women's skirts. So we may or we may not return to conduction anaesthesia, but I think the trend will continue to be toward putting patients asleep. Even the ophthalmologists and otologists and plastic surgeons will be depending on us more than they ever have, especially if we demonstrate to them how much easier it is for them to operate if they turn over to us all thought about their patient's condition. If we make the operating conditions favourable for the surgeon, as I am sure we can with meticulous attention to detail, the surgeons may be more willing to believe that it is more comfortable for a patient to be asleep than awake during a long rhinoplasty or ear operation. I don't think anaesthesiologists will ever be out of a job, even if press-button electrical anaesthesia should become popular. And I don't think the pattern of anaesthesia will ever be quite so simple as our medical student believed it to be.