

ANESTHESIOLOGY IN MILITARY MEDICINE * †

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IN the history of the medical sciences, the remarkable and swift development of surgical diagnosis and operative technic is so widely known and so well accepted that few physicians are unaware of this progress. This is true of both civilian and military medicine. However, until the beginning of the last decade, there were two important problems which were an annoyance to the surgeon and a hazard to the patient's welfare, namely, infection of wounds and operative and postoperative morbidity and mortality. The liberal use of the sulfonamides by the Army and Navy has largely controlled the problem of wound infection. The advances in anesthesiology have done much to provide for better care of the patient during operation and to allow him a greater opportunity for recovery in the postoperative period. The last ten years have been devoted to research in applied fundamental science so that the clinical anesthesiologist may use drugs properly for the safety of the patient and the convenience of the surgeon. In this manner, a specialty was created, whose members became, in effect, the internists of the surgical teams, bringing to bear upon the ever present problem of surgical relaxation the concept of an intelligent use of many drugs for the relief of pain. By virtue of this necessity, the anesthesiologist had to be well grounded in physiology, pharmacology, and the other basic sciences, since normal physiologic activity is modified greatly by administration of one or more anesthetic drugs.

From the standpoint of the Army, on superficial consideration, it might seem advantageous if a simple standard form of anesthesia were selected and rigidly maintained. The administration of one or two drugs by one or two technics might solve the needs of military practice. However, on serious reflection, the variety and gravity of disturbances of the normal function of the respiratory and circulatory systems encountered among the wounded will be at least as great if not greater than those in civilian life. Hence, the demand for versatility on the part of the military anesthetist in the use of many anesthetic agents and technics is probably most compelling (1). Simplicity is desirable if possible, but, as Bourne points out, there is no reason why the armed forces should not have the best in anesthesiology since they receive nothing but the best in surgery (2). The following case is cited as an example of the type of injury seen in the military forces, and the anesthetic considerations involved.

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The patient was a 28-year old white soldier (C. H.) upon whom open reduction of fractures of both bones of the forearm was to be done. He suffered also from traumatic pneumothorax, multiple fractured ribs, a fractured sternum and subcutaneous emphysema. Operation was performed following brachial plexus block, with no essential change in respiration or circulation during the procedure.

The problems involved are fairly obvious. The location of the contemplated operation ruled out spinal anesthesia. Local anesthesia was inadequate for pain relief because of the extensive manipulation involved. Intravenous anesthesia with one of the ultra short-acting barbiturates was considered and discarded because it could not be controlled even in fractional doses and would have been hazardous without positive pressure with oxygen. Further, the operation was expected to last one and one-half hours, and this was considered too long a period for safety in a patient with this amount of respiratory limitation during the operation and the period of postoperative depression. Ether was a poor choice even with a positive pressure apparatus because of the irritating qualities of the drug on a lung which was, presumably, at least partially infected. Nitrous oxide was unsatisfactory because of the narrow margin of safety between adequate oxygenation and asphyxia. Cyclopropane would have been a good choice if it had been available. Brachial plexus block was selected as the procedure of choice to provide the greatest possible pain relief consonant with the disturbance of respiration present in this case. In other words, pain was relieved and the chest condition was made no worse. Selection of the method and drug, and most important, the ability to employ these methods, are essential if the anesthesiologist is to perform his duty properly as a medical officer.

Pender and Lundy (3), in discussing anesthesia for war surgery, point out that the ideal anesthetic for the armed forces should be safe, portable, rapid in action, simple to give, controllable, potent, stable in storage, and without harmful after effects. Since such an ideal anesthetic is not available, the advantages and disadvantages of the various drugs in use should be considered.

One of the greatest disadvantages of some inhalant anesthetic drugs, such as ether, cyclopropane, and ethylene, is their inflammability. This property is a distinct handicap in medical installations undergoing attack because their destruction results in the spreading of fire and loss of means for relief of pain of future surgical procedures. The relative simplicity of administering ether by the open drop method and its potency and portability, however, make it a desirable drug in forward medical units. If ether is taken into these areas, it should be treated like vehicles, and dispersed in multiple, small depots so that enemy action cannot cripple the organization by the destruction of its entire supply.

Ethylene and cyclopropane are of little value in active combat areas because they offer little advantage to compensate for their explosibility and the cumbersome apparatus required for their use. Ethylene, especially, is useless, because its potency is not great. Nitrous oxide has

the same disadvantages as ethylene except explosibility, and possibly is not as valuable as other drugs for first aid treatment in this type of medical unit.

It must not be assumed that only open drop ether is of use in the medical department. Fixed installations, such as station and general hospitals, should be completely equipped with a variety of inhalation anesthetic drugs, since the gas machine is available for the administration of these agents, and with modern rapid evacuation of casualties, many emergency as well as definitive operations will be carried on in these hospitals. Kaye (4), in the middle east zone with the Australian Army, has emphasized especially the use of ether, nitrous oxide, chloroform, and cyclopropane in the military Base Hospital.

In considering the use of inhalation anesthesia for military surgery emphasis should be placed upon the simple, but fundamental principle of the free airway necessary to unobstructed respiratory exchange. The absorption of carbon dioxide from the exhaled air into soda lime, first advocated by Waters and now a widely accepted maxim in anesthesiology, is also highly desirable. The airway may be kept free by a wide variety of methods, all so common as to require little discussion, except the intratracheal method. The intratracheal tube has made many operations upon the head and face easier because of the assurance of adequate oxygenation and the prevention of aspiration of foreign material. It has permitted the thoracic surgeon to perform intrapleural procedures with a much lower mortality, and has helped give the abdominal surgeon, working under the diaphragm, a satisfactory answer to his age-old request for relaxation.

Intravenous anesthesia, particularly sodium pentothal, has proved of immense aid in military surgery. The performance of many types of short procedures, for example, closed reduction of fractures, changing of painful dressings, incision and drainage, and so forth, has been made more convenient by the use of this drug. It has been, and still is, popular with the medical corps of the British Armies for these purposes. The apparent simplicity of its use is deceptive, but respect for the potency of sodium pentothal and the restriction of its use to short procedures make it fairly safe even for the novice. Furthermore, this drug is simple to carry to combat areas, requires little equipment to administer and is noninflammable. It is not the answer to all needs, however, since it does not provide muscle relaxation for abdominal surgery, produces prolonged depression if used for long procedures, and, according to Lundy (3), is contraindicated in cases of gas poisoning, shock, and hepatic and renal damage. Beecher (5) also pointed out that the assumption that barbiturates (amytal) delay the onset of shock has not been proved. Thus, when indicated, intravenous anesthesia is useful and, if used properly, is safe.

Probably nowhere in anesthesiology is there a greater controversy than that concerning spinal anesthesia. The advocates of this method usually are surgeons because with it marked muscular atonicity and contraction of the intestines are produced, thus making abdominal procedures

easier for the operator. No attempt will be made to delve into the great mass of information on this subject, except to point out that the argument against its indiscriminate use is the circulatory depression of high spinal anesthesia (6) and the respiratory paralysis produced. Spinal anesthesia for these reasons is contraindicated in cases of circulatory depression accompanying shock and hemorrhage, and high spinal anesthesia is unwise in preexisting respiratory depression from whatever cause. Thus, a large group of patients in the armed forces is not safely anesthetized with this type of anesthesia, that is, patients with chest injuries and those suffering from shock or severe bleeding after being wounded. If the soldier patient does not suffer from these complications, spinal anesthesia is very useful because of the good relaxation, the simplicity of administration, the ease of transport of equipment, and the lack of inflammability.

Local anesthesia is a valuable tool for the military surgeon in procedures where it can provide adequate relief of pain. It is easy to perform, and the drugs are noninflammable and simple to transport. However, two important factors must be considered. First, excessive dosage in attempts to obtain pain relief, or intravenous injection of the various drugs may cause convulsions and death. Second, the commonplace contention of physicians that a patient is "unsafe for anesthesia" and the operation should be performed with local anesthesia is a fallacy. It has been said that a patient requiring operation, however poor a risk, can be anesthetized by some method that will provide pain relief, at no greater hazard than that entailed by the operation. The point involved is that the patient who is too poor a risk for anesthesia, becomes a greater risk if the operation is painful, as it is in many cases in which local anesthesia is unsatisfactory. The proper care of the patient and the intelligent use of one or more anesthetic procedures will frequently solve this dilemma. The following case is presented as an illustration.

The patient was a 31-year old white soldier (H. S.) who was admitted with gastro-intestinal hemorrhage from a bleeding peptic ulcer. He was critically ill because of severe blood loss. The pulse was feeble and rapid and the blood pressure, 75 mm. systolic and 35 mm. diastolic. There was marked anemia, with 1,860,000 erythrocytes, and an elevated blood urea value of 21 mg. per cent. The line of incision was anesthetized with 1 per cent procaine solution and operation was begun. The patient had considerable pain and was restless. Therefore, inhalation anesthesia with nitrous oxide and ether was begun before the peritoneum was opened. A transfusion of 900 cc. of whole blood was given during the operation. The pulse ranged from 110 to 144, but the level of the blood pressure rose and remained within normal limits during the course of operation. The patient made an uneventful recovery.

Despite adequate local anesthesia, it was impossible to obtain cooperation from the patient and pain relief. Since the essential need was for blood replacement and oxygen, both were supplied liberally, and nitrous oxide and ether were added in as small amounts as possible. A satisfactory result was obtained by surgical eradication of the disease which

was made possible by supportive treatment with the use of the indicated materials. Local anesthesia alone would have been great enough hindrance to the surgeon as to prohibit, possibly, completion of the operation, and the pain produced was another important factor in the aggravation of the disorder in circulatory function.

The field of regional anesthesia is too wide to cover even superficially in this discussion. Unfortunately, the various regional procedures are not commonly known but are useful for a wide variety of operative procedures. The temporary section of nerve pathways to various parts of the body with anesthetic solutions provides adequate pain relief, with minimal disturbance. For example, operation on the upper extremity may be done up to the midarm with brachial plexus block, rectal operations with caudal block, operations on the face with appropriate cranial nerve block, and operations on the neck with cervical plexus block.

In addition to providing anesthesia for surgery, nerve block technics frequently are useful in military medicine in the treatment of certain types of pain, the correction of vasospastic disorders, and as an aid to diagnosis for both surgeon and internist. The pain and disability of subdeltoid bursitis frequently may be corrected with suprascapular nerve block. The pleural pain in fractured ribs and pleuritis is amenable to thoracic nerve block in a large majority of cases. This block is especially useful since the common treatment of these conditions with opiates and immobilization by strapping defeats the fundamental principle of providing increased aeration and oxygenation. Frostbite, causalgias, phantom pain in amputated extremities, and spasm of vessels produced by trauma or infection may be improved with sympathetic nerve block. A case of venospasm of traumatic origin illustrates this point. The disability of pain was partially relieved and the diagnosis of venospasm was confirmed and abolished with lumbar sympathetic block.

This patient was a young white officer whose right leg was run over by an Army vehicle. He sustained no fractures, but his leg was swollen, cyanotic and painful. Venogram revealed spasm of the proximal third of the deep veins of the right leg. Sympathetic block of the second, third and fourth lumbar segments on the affected side produced improved color and temperature of the limb, moderate relief of pain and relief of the venospasm on roentgenologic examination.

Another useful field for nerve block procedures is the relief of pain following upper abdominal operations. This is of great importance because of the increased incidence of respiratory infections after operation as a result of decreased ventilation, due in large part to pain on breathing. The following case is illustrative of such a procedure.

The patient was a 30-year old white soldier (R. C.) upon whom cholecystectomy was performed. Inhalation anesthesia with nitrous oxide and ether was employed. Immediately after skin closure, intercostal nerve block of the sixth to tenth thoracic segments on the right side in the midaxillary line was performed with monacaine in oil. During convalescence, he had a cough for which one injection of morphine was

given on the first day, but at no time did he complain of pain in the incision. The maximal temperature was 100.8 F. Convalescence was uneventful and almost completely painless.

Time and space do not permit further elaboration upon the various conditions for which regional procedures are applicable, but consideration of disease processes carried over accessible nerve pathways frequently will indicate to the medical officer the advisability of such treatment in these cases.

Finally, the medical officer, trained in anesthesiology may contribute many related services. Restoration of fluids, intravenous therapy, the maintenance of a free airway, the supervision of artificial aids to respiration, and the management of nonsurgical, painful diseases, are fields in which he can be of value to his colleagues in other branches of medicine.

SUMMARY

1. Some of the problems confronting the military anesthesiologist are presented.
2. The advantages and disadvantages of various anesthetic drugs and methods are reviewed, with special reference to their usefulness in war surgery.
3. Brief reports of illustrative cases are given.

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