REGIONAL NERVE BLOCK ANESTHESIA

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REGIONAL nerve block anesthesia was the anesthetic procedure of choice in one particular portable surgical hospital operating in the jungles of the China-Burma-India Theater.

During a four-month period of active combat, this type of anesthesia was used for more than 3,000 surgical procedures. In comparison, general anesthesia was used in less than 50 cases.

The casualties were received from the field anywhere from a few minutes to a few hours after injury. At that time the surgical risk was so grave and the patient's condition so critical that the anesthesia became more important from the standpoint of immediate untoward effects than did the operation itself. Nearly all the patients were suffering from some degree of shock.

The following factors made regional nerve block anesthesia the procedure of choice.

(1) Regional nerve block anesthesia disturbed the physiology of the respiratory and circulatory systems less than any other anesthetic procedure. It is a well known fact that a nerve block is the only method of anesthesia which will prevent all afferent impulses from the operative field from reaching the central nervous system. Regional nerve block does not increase or cause tissue anoxia. It has been proved many times that in severe fractures of the extremities and also in the crush syndrome nerve block anesthesia has not only prevented an increase in shock but has actually improved the patient's condition.

(2) Postoperative complications such as vomiting, aspiration of vomitus, obstructed breathing, atelectasis, pulmonary edema, pneumonia and urinary retention were practically nil.

(3) The complications that sometimes occur during general anesthesia, such as laryngospasm, respiratory depression and respiratory obstruction, were absent when using regional nerve block anesthesia.

(4) Local nerve block was ideal in a case in which the patient had a traumatic pneumothorax, fractured ribs, crushed sternum or emphysema accompanying other wounds of the body. Many such cases were encountered and the results from using regional nerve block anesthesia were very satisfactory.

Another type of chest injury can be referred to as the silent chest. This type of chest resulted from the patient receiving a crushing blow or a blast injury. Many times these patients showed no signs of dam-

age to lung tissue until several hours after the actual injury. Several of these patients were operated on under regional nerve block anesthesia. Following the operation many of them expectorated blood and this was the first sign of lung damage. In retrospect, it was very fortunate that the patients had received a local anesthetic.

Other factors which made regional nerve block the anesthetic of choice were:

(1) It reduced the amount of morphine necessary to keep the patient comfortable during the immediate postoperative period.

(2) Since the patients were able to take fluids immediately, they received 4 Gm. of sulfa drug before leaving the operating table.

(3) In many instances, the patients were able to sit up when it was advantageous to apply a plaster cast in that position. This was especially true when plaster jackets were applied.

(4) Four to six surgeons were able to operate at the same time. The anesthetist was never confined to one case.

(5) It simplified evacuation by allowing several patients who were able to sit up to be transported to the rear in one ambulance. It was possible to transport only six sleeping cases in the standard Army ambulance. The patient who was awake was able to some extent to protect his injuries while riding over rough terrain.

Many times when rear evacuation was by hand litter, the less seriously wounded were able to walk when their lower extremities were not injured. This allowed more litters for the more seriously wounded. There was always a shortage of litter bearers and since the less seriously wounded were able to walk, the turnover of patients was much greater.

The technic of regional nerve block anesthesia will not be discussed but the different procedures will be referred to by name and the surgical procedures for which they were used will be designated.

Total or partial scalp blocks were used for all scalp, skull and brain injuries.

Trigeminal nerve block was used for superficial and deep wounds of the face. The facial nerve was blocked in front of the tragus to paralyze the orbicularis muscle when the surgical procedure was performed close to or in the orbit.

Patients with wounds of the neck were operated on under either *paravertebral* or *superficial cervical block.*

Brachial plexus block was used for all injuries of the upper extremity including fractures and amputations as high up as the surgical neck of the humerus.

Brachial plexus block plus blocking all the overlapping innervation around the shoulder was used for complete disarticulation of the upper extremity and for surgical procedures involving the shoulder joint.

Wrist block was used when the injuries involved only the hand.

Patients with extrapleural, superficial and nonperforating wounds of the abdomen were operated on under either *intercostal or paravertebral block.*

Patients with perforating wounds of the abdomen were operated on under either *posterior splanchnic* or *anterior splanchnic block* plus either an intercostal nerve block or an abdominal block.

Caudal sacral block was used for all injuries involving the areas innervated by the sacral plexus. Caudal sacral block plus infiltration of the spermatic cord was used for all wounds of the scrotum which involved the cord and testis.

All operations on the buttock, around the head of the femur and the entire lower extremity were performed under *unilateral caudal sacral block* plus a unilateral lumbar paravertebral block.

An *ankle block* was used when the foot was the only part of the lower extremity involved.

All eye enucleations were done under *retrobulbar injection.*

When the injury involved an area which was supplied by a single nerve that *nerve only was injected.*

DISCUSSION

One per cent procaine was used for all local procedures with the exception of blocks of the facial nerve and trigeminal nerve, which were done with 2 per cent procaine. Procaine was the only local agent used. Epinephrine, 1:260,000, was used as a vasoconstrictor.

Several of the blocks which were done with 1 per cent procaine would not have given nearly so profound anesthesia in an uninjured patient. The reasons that 1 per cent procaine gave such profound anesthesia in combat casualties are: (1) an injured person requires less anesthesia. This is especially true when shock is present, for shock carries with it a certain amount of anesthesia. (2) Each patient received sufficient morphine intravenously to relieve his acute pain. (3) In shock, the anesthetic solution is slowly absorbed due to the vasoconstriction present. The vasoconstricting action of shock plus that of the epinephrine added to the anesthetic solution allows the anesthetic agent to remain in contact with the nerve roots for a much longer period of time than normally.

It has always been considered a safe rule never to use more than 1 Gm. of any local anesthetic agent while carrying out a local injection. Adhering to this rule would have made the use of local anesthesia in most casualties an impossibility. Nearly all the casualties had multiple wounds. It was rare to see a combat casualty with but a single wound. It was soon found that 1 Gm. of procaine per hour could be safely used. By carefully increasing the dose of procaine it was found that 2 Gm. per hour could be used if this dosage were spread out over the hour as much as possible. The first gram was used during the first part of the hour

and the second gram was given any time after the first thirty-five or forty minutes. Some patients received as much as 4 Gm. within an hour.

In those cases of multiple wounds in which the surgeon had to work two or three hours, the following method of doing regional nerve blocks was used. For example, if the patient had a cranial injury, an upper extremity injury and an injury of the buttock, a scalp block was done first. Just before the surgeon completed his work on the cranium, a brachial plexus block was done and as soon as the patient could be turned on his side or abdomen a caudal sacral block was done. Using this method it was hardly ever necessary to use more than 1 Gm. of procaine per hour. It reduced the chances of the patient receiving an overdose of procaine and also prevented the anesthesia from wearing off before the surgeon had completed his work. The largest total dose of procaine given any one patient was 5 Gm. in four hours, in which time four different regional nerve blocks were done.

Between blocks on one patient the anesthetist could give a regional block to one or two other patients.

RESULTS

In 99 per cent of all patients operated on the anesthesia was complete and adequate for all surgical procedures performed.

Most regional nerve blocks afforded anesthesia from one hour and forty-five minutes to two hours and a half. Many patients had analgesia from two to four hours.

Posterior and anterior splanchnic blocks had to be supplemented more frequently than any other.

Caudal sacral and brachial plexus blocks gave the longest operating anesthesia.

Morphine intravenously was used most frequently to supplement the local blocks when they were wearing off. If it was thought unwise to use morphine, local infiltration was used as a supplement.

One per cent of the brachial plexus blocks were either incomplete or outright failures. Two cases were classed as complete failures.

Twelve patients had convulsions while under local anesthesia. Ten of the 12 had received a left sided brachial plexus block. The true etiology of the convulsions cannot be stated with certainty but it is felt that none were caused by an intravascular injection. The convulsions were easily controlled by the injection of 2 or 3 cc. of 2.5 per cent pentothal sodium. After receiving the pentothal sodium the patients went into a coma-like sleep which lasted for several hours. None of the 10 died and on awakening none showed any ill effects. The other 2 patients had wounds involving the neck and both received a superficial cervical block. Both patients died of respiratory obstruction. Both patients were breathing satisfactorily until the surgeon explored the bullet wound tract. Exploration created a lateral-airway to the trachea

through which blood and tissue debris were aspirated, causing respiratory obstruction. The sealed off bullet tract was very misleading. In both cases, the bullet perforated the trachea.

No cases of palsy or neuritis resulted from the use of regional nerve block anesthesia.

SUMMARY

Regional nerve block anesthesia has been discussed from the standpoint of actual experiences with its use in combat casualties.

From a physiologic point of view, regional nerve block anesthesia was the anesthetic procedure of choice.

No surgical procedure was ever encountered which could not be performed under regional nerve block.

Large doses of procaine are not advocated nor are large doses without danger as far as the patient is concerned but it is felt that the generally accepted dose of 1 Gm. can be exceeded with safety when the indications for its use so warrant.

REFERENCE

1. Lundy, J. S.: Clinical Anesthesia, Philadelphia, W. B. Saunders Co., 1942.

PROGRAM FOR SECTION ON ANESTHESIOLOGY FOR 1946 SCIENTIFIC SESSION

The Secretary of the Section on Anesthesiology of the American Medical Association has called the Editor's attention to the necessity for anesthesiologists to offer papers for the next program, and that wherever possible it is desirable that an exhibit be offered on the same subject as the paper. When an offer is submitted a title and a brief outline of the contribution should be sent. The deadline for accepting offers of papers is January 15, 1946. It is hoped that our membership will submit possible presentations as soon as possible to the Secretary of the Section, Dr. John S. Lundy, 102 Second Avenue, S.W., Rochester, Minnesota.