

NERVE INJURIES FOLLOWING OPERATIONS: A SURVEY OF CASES OCCURRING DURING A SIX-YEAR PERIOD*

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THE records of approximately 30,000 patients who received an anesthetic at the "Karolinska Sjukhuset" in Stockholm, Sweden, from 1940 to 1945 have been reviewed to determine the frequency with which paresis of a peripheral nerve has been found in the postanesthetic period. In addition to the usual information, special effort has been made to determine the preparation and position of the patient while he was in the operating room. It is probable that some of the nerve injuries have been overlooked, but the records revealed that 31 patients had suffered from paresis of one or more nerves during the postanesthetic period: Twenty-six of these involved the upper extremities. These are grouped into brachial plexus, 11; radial nerve, 7, and ulnar nerve, 8. In the 5 instances in which the lower extremity was affected, only the peroneal nerve was involved.

It is well known that spinal analgesia, and even spinal puncture, may produce cord or nerve damage. Four of the 5 patients with peroneal paresis had received spinal analgesia, and this technic must be considered as an etiological factor. However, the fifth patient, who had received a general anesthetic, developed an identical paresis. This demonstrates that other factors may be responsible. Thirteen of the 26 patients who experienced injuries of the nerves of the upper extremities received spinal analgesia. On one of these, a thoracic operation was performed. The remainder had abdominal procedures. Information regarding the exact levels of analgesia is too inadequate either to incriminate or to exonerate the part played by spinal analgesia in the production of these palsies.

It has been noted that injury to a peripheral nerve may occur during the postoperative period while a patient is in his bed. In this circumstance the ulnar nerve is most easily damaged. However, it is improbable that this occurred in any of the 31 patients studied.

The manner by which brachial plexus palsy may occur during anesthesia has often been discussed. One means may be by a pinching of the plexus between the first rib and the clavicle during certain movements of the shoulder. One of the movements which reduces the dis-

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tance between the clavicle and the first rib is a caudad pressure upon the shoulder when shoulder braces are used to hold a patient who is placed in steep Trendelenburg position. The distance between the clavicle and the first rib also may be reduced by pressing the shoulder dorsally while the arm is maximally abducted. It has been suggested that overextension of the brachial plexus may be important in the production of the nerve damage. Overextension may arise when the head is flexed laterally to the opposite side and extended. Overextension also may occur when the arm is in any extreme position. Some



Fig. 1.

authors attach great importance to nutrition. If the brachial plexus is exposed to an assault (compression or overextension), sufficient reduction of blood flow may result in ischemia of the plexus.

The result of roentgenologic examinations made at the "Karolinska Sjukhuset" indicate that certain rotations of the arm may produce brachial plexus injuries. If the arm is abducted to 90 degrees or more and externally rotated, the clavicle is moved dorsally. On a 46-year-old woman, with a normal shoulder girdle, a brachial plexus block was done using a roentgenographic contrast medium mixed with the anesthetic agent. On the radiographs taken shortly afterward, the con-

trast media appeared to be in the same fascial layer as the brachial plexus. The first radiograph was taken with the arm close to the body (fig. 1). The second was taken with the arm abducted 90 degrees and the arm maximally externally rotated (fig. 2). It is obvious that the rather straight course of the contrast medium seen in the first film had changed to a rather substantial curve while extending under the clavicle. The distance between the clavicle and the first rib was reduced, and the plexus was displaced laterally.



FIG. 2.

Of the 11 patients observed with paresis of the brachial plexus, 10 had Erb's paralysis (involving the upper roots of the plexus) and 1 had Klumpke's paralysis (involving lower roots). All of these paralysees were of long duration, and the briefest lasted for two and a half months. The shortest period of time in the operating room within which paresis of the brachial plexus occurred was forty minutes. In 7 of the cases the paresis apparently was produced in the same way. The patients' arms were lying on armboards and were abducted 90 degrees or more and externally rotated and forced dorsal to the frontal plane. When a Trendelenburg position was obtained, the patients' shoulders were pressed against the shoulder braces (in 5 cases) or the

ether screens (in 2 cases). This pressure forced the shoulders caudally and, in 2 cases, blood pressure was not obtained in the involved arm for some time during the operation, although a good pulse was felt in the external maxillary artery. In 4 of these cases steep Trendelenburg position was maintained for gynecologic operations and in the other 3 cases a Trendelenburg position (15 to 20 degrees) was used as a part of the treatment of shock. One of these patients had only spinal analgesia, but she was much depressed by "heavy" premedication.

In 1 of the cases, the arm was abducted about 110 degrees, maximally externally rotated, and placed a little dorsal to the frontal plane. In 2 instances the arms were at the sides of the patients. Shoulder braces were used and during most of the operation steep Trendelenburg position was maintained. In 1 of these cases, both brachial plexuses were injured. In another instance in which a lateral position was used, the arm was elevated over the head which was flexed to the other side of the body.

The following cases may serve as examples:

Case 1. A 36-year-old woman upon whom a hysterectomy was performed was given nupercaine, 1/1500, and placed in a steep Trendelenburg position. The level of analgesia was not sufficiently high, and she was given narkotal (an intravenous barbiturate), followed by ether. During this period there was violent struggling. The operation lasted two hours and five minutes, and a steep Trendelenburg position was used during this time. Shoulder braces were used on each side and her left arm was abducted more than 90 degrees, externally rotated and placed a little dorsal to the frontal plane on an armboard. Forty minutes after the operation had started, the radial pulse was not obtainable in this arm, nor was it felt during the remainder of the operation. A satisfactory pulse was palpable in the external maxillary artery, and there was no sign of shock. After the patient recovered from the anesthesia, Erb's type paresis of the left brachial plexus was observed. Roentgenologic examination was not made, but there were no clinical findings suggestive of a cervical rib. Return of function was complete two and a half months after the operation.

Case 2. An elective cesarean section was performed upon an 18-year-old woman in good condition; ether was used for anesthesia. The duration of anesthesia was one hour and ten minutes. Steep Trendelenburg position was used during the major part of the operation. Shoulder braces were employed, and the arms were stretched alongside her body. Upon awakening she observed pareses of Erb's type of both brachial plexuses. It was moderately severe in her right arm and slight in the left. Roentgenologic examination of the shoulder and the cervical spine showed no abnormalities. No signs of eclampsia were observed, and there was no history of previous nerve disturbances. Three and one-half months after the operation the only remaining paresis noted was in the right deltoid muscle.

Paresis of the radial nerve was observed in 7 cases. In these cases, as well as in the cases of ulnar and peroneal nerve paresis, there was too little information to determine the exact position of the extremity during the operation. There is, however, a strong possibility that all

pareses of the radial nerve resulted from pressure of a sharp edge of the operating table, or armboard, against the back of the upper arm in the area where the radial nerve curves around the humerus. The shortest operating time within which paresis of the radial nerve occurred was one hour. However, a paresis of the dorsal antebrachial cutaneous branch of the radial nerve occurred within forty-five minutes. In 2 cases, the pareses were persistent, and complete restitution was not attained in three months. In all the other instances the pareses disappeared in a few weeks.

Paresis of the ulnar nerve was found in 8 cases. In 7 of these, the paresis was slight and disappeared in a few weeks. In 1 case it was persistent and the patient was still slightly handicapped nine months after the operation. The only sign of paresis was sensory loss in 5 of the cases. If the injury occurred on the operating table, the briefest period for its occurrence was less than thirty minutes. In 3 cases, tenderness near the ulnar epicondyle was observed, and it is probable that sufficient pressure to produce tenderness in this area would not occur in bed. It is likely that all these pareses were produced by pressure at the elbow.

In 5 cases paresis of the ulnar nerve was observed. In 4 cases spinal analgesia was used. One patient was given ether and was anesthetized for one hour. Two straps are used for the legs, and the lower is placed 4 to 5 inches below the knee. If the leg is rotated medially when the strap is tightened, the peroneal nerve may be pinched between the strap and the fibula. In the observed cases the paresis disappeared in two to five months.

SUMMARY

Thirty-one cases of paresis after operation were observed following more than 30,000 anesthetics. Although spinal analgesia was used in many cases, trauma to the affected nerve during the operation was considered to be the cause of the paresis in most of the cases. Twenty-six of the pareses involved the upper extremities; of these, 11 involved the brachial plexus, 7 the radial nerve, and 8 the ulnar nerve. Pareses involving the leg occurred five times and involved the peroneal nerve.