

area of the inferior alveolar nerve was 11.5 C.; 7.5 C. between the bone and periosteum, and 2.8 C. at the surface of the mucous membrane. Histological studies of nerves from canine mandibles disclosed no evidence of injury. Of 52 cavities prepared for filling under local refrigeration in 33 persons, 34 instances (63 per cent) had complete anesthesia; 13 (25 per cent) had mild to moderate pain and in 5 (10 per cent), there was little or no anesthesia. 4 references.

F. A. M.

SCHILDT, EVERT: *Low Spinal Cord Injuries Following Spinal Anesthesia*. Acta chir. Scandinav. 95: 101-131 (Jan. 20) 1947.

After the initial enthusiasm over spinal anesthesia it was found that the method carried with it marked risks and criticism and skepticism followed. From the beginning there have appeared reports in the literature of complications of the nervous system following the use of spinal anesthetics. The author, after having experienced a very serious damage to the nervous system following spinal anesthesia with percaine, decided to investigate the risks. The present report deals only with those complications involving the caudal portions of the central nervous system which can occur in connection with spinal anesthesia.

Cocaine is no longer used for spinal injection. Tropacocaine is not used to a great extent. Novocaine (procaine, aethocaine) has a toxicity which is only a fraction of that of cocaine. Novocaine is a part of many preparations such as allocaine, durocaine, gravocaine, neocaine, parocaine, planocaine, syncaine, seurocaine and spino-caine. Pantocaine (decicane) is close to novocaine but the action is less certain and of shorter duration. Tutocaine is similar to cocaine in some ways but is related to novocaine.

Stovaine and alypin, also related to novocaine, are, however, harmful to tissues and the injections are painful. Percaine, which is identical with nupercaine, is used extensively in Sweden. It has a very great affinity for nerve tissue.

A study of the literature covering low injuries of the spinal cord shows that in experimental studies tropacocaine, novocaine, alypin and stovaine cause, in some experimental animals, definite spinal cord lesions. The injuries are located in the cord and are most marked near the site of injection. Nerve roots and spinal ganglia are not as a rule, involved in the damage. In clinical studies, a review of the literature shows that mild, severe, and at times fatal injuries of the nervous system are seen following spinal anesthesia in which tropacocaine, novocaine preparations, pantocaine, tutocaine, stovaine or percaine are used. The relatively few cases in which autopsy was done showed that changes occur in the spinal cord or its meninges and that they are most marked near the site of injection. The reported changes vary both in extent and intensity. In the more severe cases they advance to necrosis.

To investigate the occurrence, degree and kind of spinal cord lesion following spinal anesthesia, the author sent questionnaires to surgical centers in Sweden. A total of 121 blanks were sent and most of them were answered. More than 23,000 spinal anesthetics per year were reported. An estimated 25,000 to 30,000 spinal anesthetics per year are given in Sweden. Novocaine, percaine, decicane and tropacocaine were the only drugs used. Percaine was used in 17,500 cases of the reported series. As a rule the injection was done at a safe distance below the conus terminalis.

Six cases of postanesthetic damage of the nervous system were reported in

the series. These occurred during three years (1943-1945). A few cases which were indefinite and hard to evaluate were not included in the study. From this series of reports the frequency of occurrence of severe damages can be estimated as about 1:10,000 or about 0.01 per cent. With percaïne the figures would be a little higher. All 6 cases followed the use of percaïne.

Experiments on corpses have shown that puncture of a root with intramedullary injection via the root is hardly mechanically possible. Hemorrhages due to puncture must be massive to cause damage. Such injuries are possible but not probable. In autopsy studies of humans there were no definite findings of hemorrhage or residual hemorrhage. Severe nervous symptoms can be explained on the basis of meningeal reactions. In most of the autopsy findings in humans and in experimental studies on animals it was felt that meningeal reactions were harmless and could be accepted as a cause of damage in only a few exceptional cases. Sensitivity reactions, trophic disturbances, prolonged increase of the intradural pressure and osmotic injuries are unlikely to be the causes of injuries. Chemo-toxic effects are probably the cause of the damage. It is hard to explain why so few people are affected and the supposition must be accepted that a rare individual sensitivity exists.

Marked and severe pain occurs during the injection of the anesthetic in rare instances. When pains appear during the administration of a spinal anesthetic it is recommended that the injection should be discontinued. If surgery cannot be postponed another method of anesthesia should be used. In some cases the nervous symptoms are present when the anesthesia disappears. In some cases the symptoms appear in several weeks or in a few

months. The symptoms consist of paresthesias, pains and cramps, loss of the sense of touch and mobility. Flaccidity is usual in the beginning and may change into a spastic state. Bladder and rectal difficulties are serious. Disturbances of the sexual functions may be caused by pains or sensory disturbances. Disturbances of the circulation and of sweating are rarely seen. Decubital ulcers are common. The changes are those connected with the spinal cord and its meninges while nerve roots and spinal ganglia are either very little or not at all involved.

In a few cases all evidence of injury disappears within a few days. Most cases show improvement after months or years but the final result is usually a defective healing process with more or less marked invalidism. A few patients die, usually due to bladder impairment or infections in the decubital ulcers. Respiratory paralysis and pneumonia have been mentioned as causes of death. There is no prophylaxis against injuries which may follow spinal anesthesia. Symptomatic treatment should follow when injury has occurred. The advantages of spinal anesthesia are so great that this type of anesthesia should be retained but the risk of postanesthetic injuries should cause the anesthetist to consider other, less harmful methods when spinal anesthesia is not positively indicated. Approximately 66 references.

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SHERWIN, L. W.: *The Pharyngeal Gasway: Its Use in Exodontia*. Dental Items Interest. 69: 342-344 (April, 1947).

The pharyngeal gasway has advantages over other means of administering nitrous oxide-oxygen for the extraction of teeth and for minor oral operations. The patient lies on the table and is prepared in the usual manner.