THE USE OF A CAUDAL AIR BUBBLE IN THE CONTROL OF ALCOHOL INJECTION TO RELIEVE FLEXION REFLEXES*

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In the past, the relief of flexor spasms and rigidity in permanently paraplegic patients by intrathecal injection of ethyl alcohol has been quite satisfactory in patients having a lower thoracic subarachnoid block. When no block has been present, or when the block has been high, alcohol injection has been unsatisfactory because the alcohol could not be placed in concentration at the level of the lumbar and upper sacral roots. Where there was no block, the caudal end of the subarachnoid space had to be elevated to prevent the cephalad flow of the ethyl alcohol. This resulted in its concentration in the least dependent area—the caudal tip of the dural sac.

Recently, when confronted with this problem, it occurred to me that if the patient were placed in the lateral prone position with the buttocks elevated, the cerebrospinal fluid could be removed from the caudal sac and replaced with air in 5 cc. amounts, as in performing air myelography. Alcohol injected after this preliminary preparation would then float on the surface of the column of cerebrospinal fluid beneath the column of air and exert its concentrated effect on the nerve roots in this area. This was first done on January 10, 1957, using spinal puncture at the 12th thoracic interspace and injecting 2 cc. of absolute alcohol after first replacing approximately 25 cc. of cerebrospinal fluid with air, which filled the subarachnoid space caudal to the site of puncture. Since less than complete relief of the flexion reflexes was obtained, the procedure was repeated on the following day, using 5 cc. of absolute alcohol. All reflexes were abolished within a few seconds, and there has been no trace of recurrence in over a year. In this patient, 5 cc. of alcohol-cerebrospinal fluid mixture were removed 1 minute after injection. The concentration of alcohol was sufficient for the mixture to ignite.

During the past year, 12 patients have been injected in this manner by residents in the Neurosurgical Training Program of Baylor University College of Medicine at several of the member hospitals. The patients selected had all been paraplegic too long for any possibility of recovery to exist. Successful bilateral abolition of the defense reflexes has usually followed a single injection with 5 cc. of absolute ethyl alcohol, although in a few instances a second injection has been required. Patients who have had significant sparing of sensation in the lower extremities have not been injected unless they desired the procedure after clearly understanding that this sensation would be lost. It has been apparent that the layer of alcohol will block roots more cephalad on the nondependent side (Fig. 1). For this reason, the side of less severe flexion reflexes is placed down for the first injection. Some operators have preferred to do two injections, one on each side. There appears to be no objection to

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making the spinal puncture at the 12th thoracic interspace, or even higher if necessary, since the spinal cord at the level of puncture is serving no useful purpose. With elevation of the buttocks to bring the spine to a 45° angle with the horizontal, a single injection usually suffices. The patient need not be kept in this extreme elevation for longer than a few minutes, especially if the alcohol mixture is, in part, withdrawn. However, it has seemed wise to maintain slight elevation of the buttocks for 1 hour or more in patients with no subarachnoid block. In the absence of block, headache occurs when the position of the body permits the caudal air to ascend into the cerebral fluid pathways. The resultant changes in spasticity and bladder function obtained by injection of 5 cc. of absolute alcohol in a layer under air parallel the results obtained by Shelden and Bors when they injected 10 to 15 cc. of alcohol.

When no subarachnoid block is present, it is possible to displace the column of fluid with the alcohol floating on its surface slightly more cephalad by injecting an excess of 5 to 10 cc. of air. If this is done, any excess of air is removed at the termination of the procedure. Since the absolute ethyl alcohol produces nerve block very rapidly, it appears desirable to remove that part of it readily recovered 1 or 2 minutes after it is injected. This should minimize the possibility of adhesive arachnoiditis, which would complicate or make impossible a subsequent alcohol injection, should it prove necessary.

The procedure is of great usefulness in totally paraplegic patients whose flexor tone and flexion reflexes make proper care of the skin impossible. Even after flexion reflexes are abolished, flexion contracture, if already present, remains, and must be treated subsequently if of severe degree, although there is some tendency to spontaneous improvement. Walking with braces may become possible by some patients after injection, when it was not possible before.

In general, care of the bladder and bowel of patients has not been complicated by abolition of tone and of flexion reflexes.