

# Cleveland Clinic Quarterly

Volume 30

JULY 1963

No. 3

## INTRATHECAL INJECTIONS OF ALCOHOL OR PHENOL FOR RELIEF OF INTRACTABLE PAIN\*

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THE injection of alcohol into the subarachnoid space for the relief of chronic pain was described by Dogliotti in 1930, according to Hay, Yonezawa, and Derrick.<sup>1</sup> The intrathecal injection of phenol mixed with glycerin or myodil was reported by Maher<sup>2</sup> in 1955. Careful regulation of the concentration and amount of chemical used, as well as attention to pooling it about the roots that supply the dermatomes at the sites of pain will produce selective rhizotomy. Debilitated patients suffering from cancer with intractable pain,<sup>1-4</sup> others with benign disease causing chronic neuralgias,<sup>3, 4</sup> and spastic paraplegics with agonizing muscle spasms and painful frozen joints<sup>5, 6</sup> have been helped by alcohol and phenol blocks. These procedures are significant contributions to the neurosurgeon's armamentarium for pain relief.

This is a report on 62 injections administered to 36 patients, 29 of whom had metastatic cancer. The other seven patients had intractable pain with these diagnoses: neurofibromatosis, postherpetic neuralgia, myelopathy of unknown origin (two patients), lumbar chordoma, spastic paraplegia secondary to cerebral palsy,

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and spastic paraparesis secondary to syringomyelia. The location of pain was in the leg, lower back, and/or saddle area in these 36 patients. The frequency of area involvement was in the: leg or legs (3 patients); saddle (11 patients); lumbosacral region (one patient); lumbosacrum and legs (8 patients); lumbosacrum and saddle (3 patients); lumbosacrum, saddle, and legs (6 patients); legs and saddle (4 patients).

### Technic for Alcohol Injections

With the patient in the prone position, preferably on a proctoscopic table with the head lowered, a spinal puncture is made at the lumbosacral interspace. If the cerebrospinal fluid pressure at the lumbosacral level is subatmospheric when the stylet is withdrawn, air may enter and displace the spinal fluid from the caudal end of the sacral canal. The injected alcohol then will form a shallow layer at the lumbosacral level below the air bubble. The lowest sacral roots, passing through a shallow layer of alcohol, will not be so effectively blocked as when bathed by alcohol over a longer course. Jugular compression or the Valsalva maneuver is performed just before the stylet is withdrawn to prevent the sacral subarachnoid space from being filled with air; a tuberculin syringe of absolute alcohol is connected to the hub of the spinal needle. A continuous showing of spinal fluid at the hub will signify that air is not entering the subarachnoid space. With the patient lying prone on the proctoscopic table and tilted head down with sacrum uppermost (*Fig. 1*), from 0.5

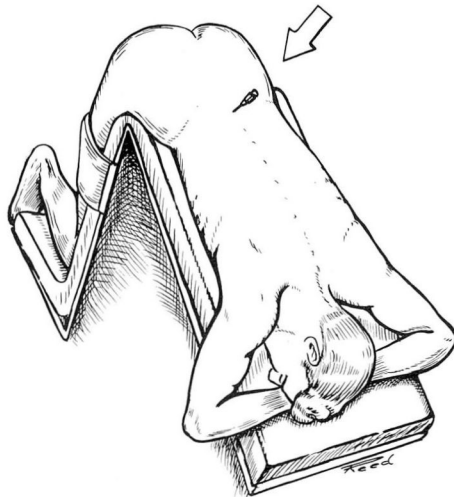


Fig. 1. Sketch showing patient in position for alcohol injection.

to 0.7 ml. of absolute alcohol is injected slowly into the subarachnoid space. The alcohol, being hypobaric, will rise quickly to the end of the caudal sac and will surround the lowermost sacral roots. Alcohol, being miscible with cerebrospinal fluid,

should be injected slowly, as the turbulence from a rapid injection would dilute the alcohol promptly and make it incompletely effective. (This principle is demonstrated by the familiar *pousse-café* in which the various liqueurs are layered by careful pouring against the side of the goblet.) Following the injection, prompt relief of pain usually occurs with analgesia of the saddle area and, occasionally, diminution of the ankle jerks. The patient's position is maintained for 30 minutes before he is returned to bed.

### Technic for Phenol Injections

Correct preparation of the phenol is necessary. We prepare 0.5-gm. samples of carbolic acid crystals that are weighed out aseptically into a *dry* 15-ml. bottle that is then sealed with a dry, sterile, rubber stopper. Just before use, either 5 or 6 ml. of Pantopaque is added to make a 10 or an 8.3 percent solution for sensory rhizotomy, or 2 or 2.5 ml. of Pantopaque is added to make a 25 or 20 percent solution for motor rhizotomy. Phenol in Pantopaque is radiopaque and can be injected under fluoroscopic control with the patient on a tilt-table. The patient is positioned on the table and is supported with hard pillows so that the nerve roots to be blocked are lowermost. Pantopaque is hyperbaric and can be layered with high selectivity over anterior or posterior spinal roots.

From 2 to 3 ml. of 8.3 or 10 percent phenol in Pantopaque is generally employed and will block from 3 to 5 roots. When the patient is lying on his side, the mixture will pool about the most dependent roots and will block the pain only on one side. If the pain is bilateral the other side may be blocked the following day. For an injection for sensory interruption, the patient is placed on his side with his back turned obliquely toward the table in order to layer the phenol over the posterior roots. For an injection for motor interruption the patient is positioned with his abdomen turned obliquely toward the table so as to pool the mixture about the anterior roots. The needle is placed in the interspace nearest the roots to be blocked, and a few drops of the phenol-Pantopaque mixture is injected. The table is then tilted so as to layer the mixture about the roots to be blocked; then the rest of the phenol is injected. Phenol loses its potency rapidly by dilution with spinal fluid if the mixture is moved up or down the spinal canal for several segments while positioning it over the proper roots. Therefore, the position of the patient should be fixed so as to prevent the pool of contrast medium from moving during the procedure. The position is maintained for 30 minutes before returning the patient to bed.

Injections for perineal pain may be given at the bedside while the patient is seated with his arms crossed over the back of a chair. From  $\frac{1}{2}$  to  $1\frac{1}{2}$  ml. of the mixture is injected by lumbar puncture and settles into the caudal sac. After an initial injection of  $\frac{1}{2}$  ml.,  $\frac{1}{2}$ -ml. increments are injected every 15 minutes until the pain relief is complete. When Pantopaque is present in the sac, phenol diffuses from the phenol-Pantopaque mixture into the spinal fluid. The residual Pantopaque

from a previous block will dilute the mixture from the repeated injection and will interfere with its effectiveness. Therefore, before repeating an injection, when Pantopaque is still present, either the patient should be tilted head down to move the residual contrast medium from the lumbosacral canal into the head, or the contrast medium should be aspirated under fluoroscopic control.

### Results

Data of 62 intrathecal injections given to 36 patients were analyzed (*Tables 1, 2*). Repeated nerve blocks were necessary in 18 of the patients, either because the first block gave incomplete or transitory relief or because the pain was bilateral, necessitating a block on the other side at a later time. Results were graded as "good" if the patient had complete pain relief for more than one month without the need for narcotics; "fair" if the pain relief was incomplete but the pain was tolerable and required less narcotic than before the injection; "poor" if the patient had some pain relief but continued to take the same dosage of narcotics; and "no relief" if the effectiveness of the block persisted less than one month.

**Table 1.**—*Results of 62 intrathecal injections in 36 patients for the relief of intractable pain*

Chemical injected	Results, number of injections				
	Total	Good	Fair	Poor	No relief
Phenol	38	12	8	4	14
Alcohol	24	7	6	5	6
Total	62	19 (30.6%)	14 (22.6%)	9 (14.5%)	20 (32.3%)

**Table 2.**—*Results in 36 patients after intrathecal injections for intractable pain*

Chemical injected	Results, number of patients				
	Total	Good	Fair	Poor	No relief
Phenol	23	11	4	2	6
Alcohol	13	7	2	0	4
Total	36	18 (50%)	6 (16.6%)	2 (5.6%)	10 (27.8%)

Eleven patients had good results. Eight of them were completely relieved by one injection each. One patient with a lumbar chordoma had no recurrence of pain for one and one-half years; another patient with a painful spastic neurogenic bladder had the first recurrence of pain seven months after the nerve block. Five of the

seven patients with good results after alcohol block died—one at one month, one at one and one-half months, two at two months, and one at 15 months after the block. The sixth patient, two months before the nerve block, underwent a unilateral cervical cordotomy that failed to relieve her pain. After four alcohol blocks (the first three blocks were not effective) she had pain relief for three years and nine months. When the pain recurred, she underwent a bilateral cervical cordotomy. The seventh patient continued to be free of pain four years and three months after the nerve block.

Six patients had fair results. Each took some analgesic after the block. It is not known whether the narcotic was for discomfort due to the block, to residual pain, or to a basic addiction. Whether the patients took either no further narcotics or increased amounts after returning home, also is not known. Results in three of those patients were indeterminate because they were in the hospital only one or two days after the block and had no follow-up examinations. Of the remaining three patients, two subsequently underwent cordotomy; the one patient had previously undergone cordotomy three times.

Of the two patients having poor results, one patient died 12 days after nerve block, and it is probable that administration of narcotics to this patient was a token gesture to assure comfort in his terminal care. The other patient with painful muscle spasticity secondary to syringomyelia had partial relief for only one month.

Ten patients received no relief. One had been given an intrathecal injection of phenol for the relief of postherpetic neuralgia, and was free of pain for 16 days. It is well known that even surgical rhizotomy is ineffective in the treatment of postherpetic neuralgia. Three patients subsequently underwent cordotomy, and one patient a transorbital leukotomy. One of the patients who underwent cordotomy had two previous alcohol injections with relief for six months and two weeks respectively. He also had two phenol injections that were ineffective. Two patients in this group were addicted to narcotics, and although one had analgesia produced by each of the two alcohol blocks, he would not say that he was relieved of pain. Several examiners reported that the other patient also could not distinguish between the head or point of a pin in the area where she complained of pain.

Thirteen patients with saddle pain received alcohol injections, and subsequently six patients had transient and three had permanent loss of bladder control. Fourteen patients with saddle pain received phenol injections, and subsequently two patients had transient and one patient had permanent loss of bladder control.

Four patients each had weakness of the legs after the injection. One of these patients had been given 1 ml. of alcohol, and the other three had received 3, 4, and 5 ml. of phenol-Pantopaque in 8.3, 8.3, and 10 percent concentrations respectively. The concentrations of phenol in the 38 phenol-Pantopaque blocks ranged from 7 to 25 percent. Only two of the 24 alcohol injections were a full milliliter of absolute alcohol, the usual dose being from 0.3 to 0.7 ml. Two patients who received 1 and 4 ml. of 10 and 7 percent phenol, respectively, had transient painful pares-

thesias. Forty of the 62 blocks were followed by persistent subjective numbness, and 37 by demonstrable sensory loss.

### Discussion

Nathan and Sears<sup>7</sup> found that intrathecal injections of from 5 to 10 percent phenol gave satisfactory relief from intractable pain. They noted that within one or two minutes of injection a loss of sensibility and a nearly complete local paralysis developed; both effects diminished greatly within 15 minutes. The chronic effect consisted of relief of pain, with no or almost no impairment of sensibility or movement. In an experiment with cats, they noted that smaller C (pain) fibers were blocked first, than A (motor) fibers, as in the action of a local anesthetic. The block of A fibers is reversible and that of C fibers is irreversible. We have noted no paralysis after sensory nerve block in our patients, and believe that the absence of this complication may be due to careful attention to layering the phenol over the dorsal roots by turning the patient's back obliquely toward the table. This technic is effective for lumbar blocks only, and cannot be utilized effectively for sacral blocks because of the proximity of anterior and posterior sacral roots as they leave the spinal canal.

Iggo and Walsh<sup>8</sup> also reported differential susceptibility of the nerve fibers, the later components of the compound action potential being more susceptible than the earlier components. When natural stimuli were used, proprioceptive fibers were more resistant than cutaneous fibers. For this reason, in treating painful spasticity in the paraplegic patient we use a solution of double the usual concentration—about 15 to 20 percent—because the larger motor fibers are somewhat resistant to destruction by the usual 10 percent mixture. The usual concentration lends a margin of safety to sensory chemical rhizotomy, but, none the less, will cause some histologic motor root destruction if allowed to pool about motor nerves.<sup>9, 10</sup>

In our experience there was a distinct difference in the effects of alcohol and of phenol, when used for sacral blocks, with respect to the loss of sphincter function. When sphincter function is already lost (as in a patient with a Bricker's pouch and colostomy), we prefer to use alcohol rather than phenol. Phenol is effective in the lumbar area because radiographic localization allows one to confine the effects of the carboloid acid to the roots that need to be blocked.

In our series, three patients each received four nerve-root blocks, two patients each received three blocks, and 13 each received two blocks. When the first injection fails to relieve the patient, another injection should be given the next day. Early in our experience with phenol we were discouraged by poor results from first injections and did not repeat the injections. With later patients, however, we recognized the need for repeating the block, and consequently the relative proportion of good results increased dramatically. It should be explained to the patient before the initial injection that more than one injection may be necessary for pain relief. We

found no correlation between the frequency of blocks and the incidence or severity of side effects, or between the amount or concentration of phenol and the effectiveness of the block while using at least 7 percent phenol.

### Conclusion

The intrathecal injections of alcohol or phenol offer short-term relief, especially for the patient who is in the terminal stage of cancer: he can be made more comfortable for one or two months by freedom from pain and narcotics before his demise. Even the most debilitated patient can tolerate repeated injections with few significant side effects.

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