The authors explore an anesthetic technique that utilizes incremental subnarcotic doses of methohexital for electro-coagulation of the Gasserian ganglion, drawing from 21 such cases.

Electro-coagulation of the Gasserian ganglion was introduced in Germany by Kirschner in 1931. In recent years, the percutaneous approach to coagulation of the ganglion for treatment of trigeminal neuralgia has gained in popularity.

Sweet and Wepsic recently reported on 353 patients stating that "the patient's cooperation is maintained by the use of the neuroleptanesthetic Innovar® and the production of brief unconsciousness for the painful parts of the operation by methohexital (Brevital®)."

At the University of California, Davis-Sacramento Medical Center, 21 percutaneous trigeminal rhizotomies utilizing the Innovar-Brevital® regimen have been performed by several surgeons. Our anesthetic techniques and results follow.

Methods
The patient is admitted to the hospital the day prior to the procedure. A history, physical, routine laboratory tests, a chest x-ray, and ECG are obtained.

Operating technique
Premedication is Innovar® 1-2 ml intramuscularly one hour prior to the operation, and the procedure is performed in the x-ray department. The patient is monitored with a cardioscope, blood pressure cuff, and chest stethoscope. An intravenous catheter is placed. After anesthetizing the nasal mucosa of the patient with a cotton pledget dipped in 4% lidocaine or cocaine, we insert a nasal airway.

The technical aspects of the procedure differ little from Onofrio's modification of the description by White and Sweet. A needle is placed in the patient's forehead to serve as an indifferent electrode. After surgical preparation and local infiltration of the appropriate buccal region, a 19-gauge needle, insulated to within 5 mm of its tip, is passed from the angle of the mouth to the base of the skull. The needle passes medial to the coronoid process of the mandible. A finger placed in the patient's mouth allows the tip of the needle to be palpated so that penetration into the oral pharynx can be avoided.

If the patient's neck can be hyperextended, fluoroscopy can be used to follow the needle as it penetrates the foramen ovale. In older patients, the neck frequently cannot be hyperextended and repeated radiographs are used for guidance. Penetration of the foramen ovale is moderately painful. At this stage, methohexital in sub-anesthetic doses is first given. Once in the skull, stimulation by means of the exploring needle is used to identify the rootlets subserving the portion of the face in which neuralgia has been reported.
After the needle tip is properly positioned, methohexital in a dose range of 60-90 mg is given intravenously and a 20-second radio frequency lesion at 80° is created. The patient is allowed to recover from the anesthetic, and the dermatome involved is retested. If hypalgesia is not noted in the area of pain, the lesion is repeated. Successive lesions are created with testing between each lesion until appropriate hypalgesia is present. The procedure is then terminated and the patient is taken to the recovery room and allowed to recover fully. Patients can usually be discharged from the hospital the following morning.

**Patients**

The procedure was performed on 21 patients from mid-1974 to December 1976. Ten were men and 11 were women. Eleven patients had trigger points on the left side of the face, nine on the right, and one patient's pain was perioral. Ten patients were under the age of 55, and 11 were over, the range being 45-77 years. The duration of the symptoms from onset to the time of surgery ranged from 1 month to 25 years.

Nine of the 21 patients had unrelated diseases of major significance. There were two with multiple sclerosis, three with alcoholic cirrhosis, two with diabetes mellitus, and one with nasopharyngeal carcinoma; the latter having had two remote myocardial infarctions.

All of the patients had been treated with medications varying from codeine to carbamazepine (Tegretol®) and phenylhydantoin (Dilantin®), with varying degrees of pain relief. However, at the time of surgery, none of the medications were providing satisfactorily relief.

Weight loss, due to the inability to eat because of the triggering of the pain, was significant in eight of the 21 patients. One man reduced from 175 pounds to 112 pounds over a period of seven months.

One patient had had a previous percutaneous rhizotomy for tic douloureux. Three patients had had alcohol blocks of a peripheral portion of the trigeminal nerve, and four had had decompression of the ganglion. Remission of pain following these procedures varied from a few months to two years.

**Complications and side effects**

It is of interest to note that during the moments of the thermocoagulation of the Gasserian ganglion, 16 of the 21 patients had a significant rise in blood pressure. (See Table 1 and Graph 1). An attempt will be made to explain this phenomenon in the subsequent discussion. Two of the patients developed acute meningitis which responded to proper antibiotic therapy.

One of the patients developed apnea intraoperatively and had to be artificially ventilated with oxygen via a mask. This particular individual had received a total dose of methohexital of 920 mg during a prolonged procedure lasting 3 hours and 15 minutes.

**Discussion**

The purpose of the procedure is to alleviate the pain of trigeminal neuralgia. Although sufficient time has not elapsed for long-term evaluation, pain relief was achieved in each of the 21 patients.

Methohexital, alpha-dl-1 methyl-5-allyl-5 barbiturate sodium was intro-

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**Table 1**

A calculated difference of the changes in blood pressure occurring during the pre-intra and post-operative period.

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>During</th>
<th>End of Surgery</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Mean</td>
<td>92.1</td>
<td>121.8</td>
<td>106.3</td>
<td>99.7</td>
</tr>
<tr>
<td>Standard Error of Mean</td>
<td>5.67</td>
<td>5.3</td>
<td>3.8</td>
<td>6.2</td>
</tr>
</tbody>
</table>

August/1977
Graph 1 Illustrates the changes in blood pressure of the patient during pre-intra and post-operative period expressed as a percent of presurgical control.

Produced originally as an intravenous agent by Gruber and V. Stoelting in 1956. It is one of several ultra-short-acting barbiturates which has found widespread clinical use in situations requiring rapid and complete recovery from a short anesthetic administration. However, as with all anesthetic drugs, its use in either full- or sub-anesthetic dosage, has the potential for catastrophe, particularly for the unwary and the unprepared.

The considerable and rapid hypertension observed in 16 of the 21 patients during the creation of the lesion is one case in point. This rise is probably the result of sympathetic discharge elicited by the painful stimulus of the "burn" potentiated by the antianalgesic effect of methohexital.

Clutton-Brock in 1960 demonstrated that thiopental, a closely similar drug, in subnarcotic doses not only had no analgesic effect, but actually counteracted the demonstrated analgesic effects of concomittantly administered nitrous oxide and meperidine. Dundee in 1964 showed that similar results were obtained with methohexital, although the antianalgnesia was of shorter duration. He concluded that antianalgnesia was a property of all barbiturates.

Consequently, one should not be surprised by an elevation of blood pressure in response to a painful stimulus during methohexital "anesthesia". It is important that one be aware of the potential and be certain that patients chosen for this procedure do not have uncontrolled hypertension and/or severe arteriosclerotic disease, which could lead to either acute myocardial overload or stroke because of excessive blood pressure rise.

Further, one should not be surprised that apnea ensued in one of our patients. Mann, et al, reported apnea in 183 of 578 (32%) methohexital inductions; and the incidence during maintenance was 51 of 578 (9%). This is a well recognized side effect of all rapidly administered intravenous barbiturates, especially when combined with premedication which includes narcotics. In the present instance, the premedicant drug
mixture, Innovar®, contains the extremely potent synthetic narcotic, fentanyl, whose respiratory depressant effects are well documented.8,9

Also, if sufficient dosage is given to render a patient unresponsive, one cannot only anticipate apnea on occasion, but respiratory obstruction as well. If the patient is “breathing room air” and obstruction is not recognized promptly, hypoxemia develops within a short period of time. We believe, as stated in the British Medical Journal, (February 8, 1975), “... the most contentious question is whether one man should combine the duties of operator and anesthetist.”10

The literature is replete with disasters that have occurred intraoperatively utilizing a “fatally easy” anesthetic technique. In two issues of the British Medical Journal (February 8, 1975, and November 9, 1974) can be found detailed examples of intraoperative dental deaths using subnarcotic doses of methohexital.10,11 Bjorn Lind, et al, in 98 patients, nicely summarized the varied side effects of methohexital when used in outpatient procedures.12 These included shivering in 10 patients, hiccups in 31, involuntary movements in 8, and cough in 11 patients. These are recognized occurrences and should be anticipated, even though our study did not show evidence of many of these known effects.

All of the previous examples underline the common sense implied in the statement in the American Medical Association Drug Evaluations in 1971: “Methohexitone sodium should be administered only by individuals well versed in the use of anesthetics given intravenously; facilities for providing oxygen and for ensuring a patient airway and adequate respiration should be available at all times.”13 Under the special circumstances encountered in its described use during percutaneous trigeminal rhizotomy, one might be well advised to add, “...and the individuals should be capable in the management of acute hypertensive crises, including the use of appropriate pharmacologic antagonists if necessary.”

Conclusions

The development of the technique of percutaneous radio-frequency thermo-coagulation of the trigeminal ganglion has been a significant advance in neurosurgery. The relief to the patient is almost complete and seemingly long lasting. The operation per se is usually of a lesser order risk than the previously performed craniectomy for the relief of tic douloureux.

However, when anesthesia is offered to a patient, one should always be cognizant of the potential hazards of the anesthetic used. It follows that during the procedure carried out under anesthesia, a person trained in giving anesthetics and resuscitation should be with the patient, employing suitable monitoring of vital functions.

After all, the safety of the patient is our primary concern and although in this situation we are dealing with allegedly subnarcotic doses of drugs, the margin of error with respect to respiratory depression is narrow and it is important to realize that we cannot become complacent. Even a single preventable tragedy cannot be condoned.

REFERENCES

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