Chapter 8

Glycerol Rhizotomy as a Treatment Modality for Trigeminal Neuralgia

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ABSTRACT

In this chapter, the authors discuss the use of glycerol rhizotomy (GR) as a treatment modality for trigeminal neuralgia. GR was first described by Håkanson and has been used for more than 40 years as a minimally invasive, safe option for the management of facial pain. Here, the authors discuss the history behind the discovery of GR, relevant biochemical mechanisms of neurolysis, indications, a step-by-step procedural outline for GR and intraoperative cisternography, potential side effects, efficacy of treatment, and new applications for the imaging technique. GR has stood the test of time in neurosurgery, and this chapter demonstrates its utility in patients who are poor surgical candidates for microvascular decompression and for whom medical treatment has failed to manage their intractable pain.

INTRODUCTION

Trigeminal neuralgia (TN) has the highest incidence in elderly patients, many of whom also have comorbid medical conditions that preclude long, invasive surgical procedures under anesthesia to treat their facial pain. Glycerol rhizotomy (GR), as described in this chapter, is an appropriate procedure for these individuals.

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Percutaneous GR poses little surgical risk, may be performed under local anesthesia, and carries a favorable side-effect profile; thus, it is well suited for many patients with trigeminal neuralgia who would not be able to tolerate either the invasiveness of direct decompression or potential adverse effects of anticonvulsants, such as carbamazepine, traditionally used for this condition.

BACKGROUND

History of Glycerol Rhizotomy

Like many paramount medical treatments, the discovery of glycerol’s neurolytic effects and potential therapeutic application in TN was made by chance. During the 1970s in Stockholm, stereotactic gamma knife radiation was used in an attempt to ablate the trigeminal (gasserian) ganglion and dull pain signals in TN patients. Both glycerol and metrizamide were trialed as carriers of tantalum dust—a radiopaque material—that was injected to the trigeminal cistern as a visual waypoint for stereotactic calculations (Håkanson & Leksell, 1979). Glycerol became the medium of choice because of its documented role in human triglyceride synthesis, favorable viscosity, and prior use as a vehicle for phenol neurolysis, which was the predominant percutaneous TN treatment of the time (Jefferson, 1963). Håkanson and colleagues began to notice that injection of the medium alone appeared to relieve facial pain before the radio-ablative procedure was set to take place. The group subsequently outlined a method for the direct injection of glycerol into the trigeminal cistern and published the first case series in 1981 (Håkanson, 1981).

Mechanism of Neurolysis by Glycerol

Glycerol (C\textsubscript{3}H\textsubscript{8}O\textsubscript{3}) is a colorless, odorless trivalent alcohol that serves as a precursor for phospholipid and triacylglycerol synthesis in the human liver and adipose tissue. Glycerol’s three hydroxyl groups and carbon backbone yield a molecule with a versatile solubility profile, allowing it readily dissolve in water as well as easily traverse animal cell membranes. Additionally, glycerol is a relatively benign chemical, with feline studies demonstrating that large quantities of 7.5%–15% solutions injected directly into the lumbosacral subarachnoid space are required before systemic damage occurs in the form of proliferative arachnoiditis and widespread peripheral demyelination (Baxter & Schacherl, 1962).

Glycerol’s mechanism of neurolysis is two-part, stemming from the disruption of tight junctions between Schwann cells and the outer axolemma of peripheral nerves, and hypertonicity osmotic shifts resulting in neuron damage. Small-diameter,
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