DEGENERATIVE DISEASE AND INJURY OF THE BACK

Chemonucleolysis in the Treatment of Lumbar Disc Disease

Henry W. Apfelbach, MD

Chemonucleolysis is the injection of an enzyme, chymopapain, into the intervertebral disc space. Lyman Smith working with Ivan Stern and Robert Gesler started an investigative program in 1963 to determine the efficacy of this procedure. Smith and Brown enlarged upon the original technique of Lindblom in diagnostic disc puncture, with injection of radiopaque medium to demonstrate various pathologic states of the intervertebral disc. Thus far, chemonucleolysis has been done in over 15,000 patients in the treatment of discogenic pain.

ANATOMY AND PHYSIOLOGY OF THE INTERVERTEBRAL DISC

The intervertebral disc is composed of three parts: the cartilaginous (hyaline) endplate of the vertebral body; the annulus fibrosus, a meshwork of very dense collagenous fibers which surrounds and encloses the disc material and is attached to the adjacent vertebral bodies. A less dense meshwork extends into the central regions of the disc material; and the nucleus pulposus, which occupies the center of the disc space and is composed of a thin meshwork of collagenous fibers with mucoprotein gell (with bound water) in the interstices.

With aging, there is depolymerization of mucoproteins and decrease in water content in the disc. This change is commonly termed "degenerative disc disease."

CHYMOPAPAIN

Chymopapain is an enzyme isolated from the latex of the papaya. This enzyme in contact with the disc causes depolymerization of mucoprotein but has no effect on collagenous structures such as the annulus fibrosus, the ligamentous structures about the vertebral column, or the sheaths of nerve roots. Studies by Gesler on animals with usual therapeutic doses of the enzyme have shown a several hundredfold margin of safety of chymopapain when properly injected in the disc space.

INDICATIONS FOR CHEMONUCLEOLYSIS

The indications for chemonucleolysis are the same as those for laminectomy: failure of response to conservative treatment (absolute bed rest for 10 to 14 days); frequent recurrent episodes of sciatica; and inability to pursue gainful employment. It is my opinion that chemonucleolysis will eventually find its place between conservative treatment and open surgery, the latter to be done when chymopapain injection fails to relieve symptoms. With chemonucleolysis, instability caused by the surgical approach to the disc is avoided. Further, the patient does not have evidence of an open surgical operation on his back, which frequently prevents his being hired.

Chemonucleolysis should be considered if laminectomy has failed, especially in that group of patients who achieved a satisfactory clinical result which lasted for one year or more following their laminectomy. A second laminectomy frequently fails because of inability of the surgeon to penetrate scar and reach the area of pathology. In many of these patients, repeat laminectomy also creates additional scarring and further increases instability of the low back.

CONTRAINDICATIONS

Contraindications to chemonucleolysis are as follows:

1. Rapidly developing neurologic deficit in which paraplegia is feared. In this instance, immediate laminectomy is indicated.
2. Severe neurologic deficit, e.g., foot drop, or evidence of cord bladder, in which the probability of completely extruded fragment of nucleus pulposus is high.
3. Spinal stenosis: the incidence of spinal stenosis, or narrowing of the spinal canal, is greater with increasing age. The syndrome of spinal claudication in the absence of a Leriche syndrome should suggest spinal stenosis. The patient's sciatica occurs chiefly on walking. Spinal stenosis can be adequately diagnosed only with myelography.
4. Patients who have been diagnosed as having arachnoiditis; this group of patients almost invariably has had at least one myelogram and one laminectomy.
5. Pregnancy.

6. Previous chemonucleolysis. Risk in this group of patients is purely theoretical (increased chance of anaphylaxis).

PREOPERATIVE EVALUATION

In addition to routine admission history, physical examination and routine laboratory studies including electrocardiography, the following should be considered:

1. Electromyography, performed by a proficient electromyographer, is of value if fibrillation potentials can be shown. A negative electromyogram, however, does not rule out the presence of a herniated disc.
2. Myelography, if chemonucleolysis is anticipated. This procedure's main value is that of ruling out spinal stenosis and spinal cord tumor.
3. Epidural venography.
4. Psychometric testing (Minnesota Multiphasic Personality Inventory) is, in general, regarded to be the most reliable test in prognosticating the effectiveness of chemonucleolysis or laminectomy.

TECHNIQUE OF CHEMONUCLEOLYSIS

Chemonucleolysis may be done either in the special procedures room of an x-ray department or in the operating room. Many surgeons prefer general anesthesia because the patient is intubated and can be maintained with an open airway in the event of anaphylactic reaction to the enzyme. Others prefer local anesthesia.

After being anesthetized, the patient is placed on his left side with elevation of his left flank so that the pelvis "falls away" and tilts to the right. Each surgeon has a somewhat different technique for achieving this position, and special radiolucent operating tables are often used.

Following surgical preparation of the patient, discography is done under fluoroscopic control through the lateral approach. With this approach, it is unnecessary to penetrate the dura. The needles are placed "bull's eye" in the center of at least the lowest two disc spaces, and very frequently the lowest three

disc spaces. One to five cm of a water-soluble dye (Conray 60) is injected into each disc space. Roentgenograms are taken in both the anteroposterior and lateral projections and usually reveal one of the following: (1) a normal disc, (2) a degenerated disc, (3) a protruded disc, or (4) an extruded disc, which is suggested by an epidural leak of the dye up and down the spinal canal.

In general, abnormal discs, including those which are "degenerated," are subjected to chymopapain injection. The ideal dose appears to be 3,000 units. Most investigators have felt that the degenerated intervertebral disc should be subjected to chymopapain injection because the degenerated disc of today may become the herniated disc of tomorrow. Following injection of chymopapain, the patient is monitored for anaphylaxis.

POSTOPERATIVE TREATMENT

The only thing predictable about chemonucleolysis in the immediate postoperative period is its unpredictability. Many patients awaken completely relieved of back pain and sciatica. More important, however, in predicting the effectiveness of a chymopapain injection, is the relief of sciatica, or at least a change in the character of the patient's sciatica, during the next few days.

Virtually all patients are able to get up to go to the bathroom on the evening of surgery. The level of activity is regulated on an individual basis. Patients are told to avoid sitting as much as possible. They remain recumbent but may take frequent short walks. Patients with severe low back pain should be treated with hydrotherapy. Muscle relaxants and William's exercise appear to be of no value. Average hospitalization is four days.

In general, the patient should remain out of work a minimum of three weeks from a sedentary occupation and six weeks from light labor. The results of chemonucleolysis are covered in the paper by Dr. Eugene Nordby.

COMPLICATIONS

1. Anaphylaxis: the incidence of anaphylaxis is slightly less than 1%.

2. Traumatic neuritis: with improper technique the spinal nerve can be traumatized at its point of exit from the intervertebral foramen.
3. Post injection backache: this may be prolonged. It is our opinion that its incidence is significantly reduced by a program of steroid therapy for the first four days following injection.
4. Disc space infection: we have not encountered this rare complication.

NIOSH

OCCUPATIONAL SAFETY AND HEALTH SYMPOSIA 1977

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

OCCUPATIONAL SAFETY AND HEALTH SYMPOSIA

1977

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
Division of Technical Services
Cincinnati, Ohio 45226

June 1978

For sale by the Superintendent of Documents, U.S. Government
Printing Office, Washington, D.C. 20402

DISCLAIMER

The contents of this report are reproduced herein as received from the contractor except for minor editing. The opinions, findings, and conclusions expressed herein are not necessarily those of the National Institute for Occupational Safety and Health, nor does mention of company names or products constitute endorsement by the National Institute for Occupational Safety and Health.

NIOSH Project Officer: Loren L. Hatch, DO, PhD
Principal Investigators: Theodore C. Doege, M.D.
Robert H. Wheater, M.S.

Contract #210-77-0088

DHEW (NIOSH) Publication No. 78-169