Low-Dose Chemonucleolysis Combined with Percutaneous Nucleotomy in Herniated Cervical Disks

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Summary: The combination of low-dose chemonucleolysis with 500 IU chymopapain followed by an automated percutaneous nucleotomy of the cervical spine is a new procedure. A follow-up of at least 1 year of the first 22 patients showed in 19 patients good or excellent results. In one patient a fair result was obtained, and in two patients the symptoms were unchanged; one of these patients subsequently underwent discectomy and anterior cervical spine fusion. Preoperatively, all patients showed a clear cervical disk herniation with predominantly radicular pain. The procedure has been performed so far in ~100 patients. No intra- or postoperative complications have been noted. Key Words: Chemonucleolysis—Chymopapain—Percutaneous discectomy—Minimal invasive surgery—Cervical disk herniation—Neck pain—Radicular pain.

Mechanical percutaneous nucleotomy of the lumbar spine was introduced by Hijiwata et al. (5). Davis et al. (3) reported on the results of the automated percutaneous nucleotomy of the lumbar spine. Kambin et al. (7) reported on the results of the mechanical endoscopic percutaneous nucleotomy of the lumbar spine. Both procedures appeared to be effective in contained lumbar disk herniation. In several meetings Bonati (1) has reported on the use of the automated percutaneous nucleotomy of the cervical spine by intraforaminal cervical disk herniations.

Chemonucleolysis is an extensively studied therapy in lumbar disk herniation. The use of chymopapain in the cervical spine was first reported by Gomez-Castresana in 1992 (4).

To our knowledge, no data have been reported on the combined therapy of low-dose chemonucleolysis and percutaneous nucleotomy. The senior author Hoogland (6) has studied 100 cases of the combined therapy of low-dose chemonucleolysis with automated percutaneous nucleotomy of the lumbar spine and found a high success rate.

From March 1991 until April 1993, 95 patients underwent diskography followed by low-dose chymopapain injection and subsequent automated percutaneous nucleotomy with the Surgical Dynamics (Concord, CA, U.S.A.) nucleotome.

In April 1992, 22 patients had completed a follow-up period of at least 1 year and became the subjects of this study.

PATIENTS AND MATERIALS

Twenty-two subsequent patients treated between March 1991 and April 1992 who presented with a cervical disk herniation and unsuccessful improvement with conservative therapy underwent the procedure.

The age range of the patients was 30–53 years (mean 43). Thirteen patients were women and nine were men. All patients had a neck pain radiating from
below the elbow. In 15 cases the left side was affected, and in seven cases the right side.

All patients had a cervical disk herniation, with or without degenerative changes at the affected segment, proven by either computed tomography (CT) or magnetic resonance imaging (MRI). The radicular pain was the main complaint in all cases, which increased by extension and relieved at rest. Most of the patients had abnormal neurological findings, with either sensory disturbances in the typical dermatome distribution, typical reflex difference in comparison with the contralateral side, or a muscle weakness (Table 1). They all underwent a preoperative electromyographic examination, which showed a poor correlation with the radiographic diagnosis.

**METHODS**

All procedures were performed on an out-patient basis. The procedure was performed under local anesthesia with an anesthesiologist standing by. Fifteen minutes before the procedure was started, the patient received 1–2 mg Alfentanil (Janssen, Neuss, Germany) intravenously as an anesthetic, 2 g of Cephalo-
lin (Boehringer, Mannheim, Germany) as antibiotic prophylaxis, and 250 mg methylprednisolone and 2 mg clemastine as antiallergy prophylaxis. During the procedure, up to 5 mg of Midazolam (Hoffmann-LaRoche, Grenzach-Wyhlen, Germany) was given as sedation.

The procedure was performed on a special radiolucent operating table with sterile draping with the aid of an image intensifier. After preparation and draping, the skin was marked at the level of the affected disk. Then the skin was anesthetised ~3 cm ipsilateral from the midline with 1% Xylocaine (Astra Chemicals) plus adrenaline. An 18-gauge spinal needle was then introduced through the skin. The trachea and thyroid gland were pushed to the contralateral side, and the spinal needle was inserted in the disk space, medial to the carotid sheet under anteroposterior (AP) and lateral image intensifier control. Care was taken to introduce the spinal needle ~0.5 cm ipsilateral to the midline. Then a diskography was performed with 0.5 ml Omnipaque (Schering AG Pharma, Berkum, Germany).

As a rule the patient experiences pain during the dye introduction. AP and lateral radiographs were taken to check for dye leakage in the epidural space. Foraminal dye leakage was often seen. Subsequently 500 IU chympopapain was slowly injected intradiskally. A fine Kirschner wire was then introduced through the spinal needle, and the spinal needle was withdrawn. Next, a 16-gauge needle was carefully pushed over the Kirschner wire and watched for bloody return. At no time was arterial blood noticed.
Subsequently a 2-mm nucleotome (Surgical Dynamics Inc., California) was introduced over the Kirschner wire and directed to the ipsilateral and posterolateral segments. Ten minutes after chemonucleolysis, the nucleotome was used for another 10 min. The nucleotome removed the posterolateral segment of the disk, and the tip of the nucleotome was introduced for 2–3 mm into the lateral foramen (Figs. 1 and 2). Triamcinolone (0.5 ml; depot corticosteroid) was left behind intradiskally. Then the instruments were removed. The skin incision was closed with a steristrip.

Two hours after the procedure, the patient was mobilized without a collar and was discharged. The following day, a postoperative follow-up with dressing change was performed.

One week after surgery, a physical therapy program was started, with strengthening and mobilizing exercises for 4–6 weeks.

All 22 patients were free of symptoms on the first postoperative day. Follow-up was performed with a questionnaire, comparing the preoperative and follow-up neck pain, radicular pain, and sensory disturbances, as well as the general satisfaction of the patient.

RESULTS

Level

The procedure was performed in each patient at a single level only. The disk herniation was located at the C6–7 level 12 times, C5–6 level nine times, and C4–5 level one time (Fig. 3).

Subjective Results

Ten patients regarded the result of the operation as excellent, nine as good, and one as moderate. The
symptoms of two patients were unchanged; in one of them a subsequent discectomy with anterior interbody fusion was performed with only minimal improvement of the symptoms (Fig. 4).

Radicular Pain

Twelve patients reported complete disappearance and seven reported a clear improvement of the radicular pain. In two patients there was a moderate improvement of radicular pain, and no improvement occurred in one patient (subsequent fusion) (Fig. 5).

Neck Pain

Seventeen patients reported a clear improvement of neck pain, and three patients reported a moderate improvement. In two patients the neck pain was unchanged, including the patient who underwent a spinal fusion at a later date. The other patient with persistent neck pain had complete relief of radicular pain, but was objectively not satisfied (Fig. 6).

Sensory Disturbances

Thirteen of the 14 patients with preoperative sensory disturbances reported a complete disappearance of the symptoms, and one patient’s disturbances were improved except for persistent hypesthesia in the ring and little fingers.

A summary of the results is provided in Table 2.

COMPLICATIONS

No complications were noted in these 22 patients, and no complications have occurred in the first 95 cases that have been treated with this procedure so far.

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**TABLE 2. Postoperative results**

<table>
<thead>
<tr>
<th>Patient outcome</th>
<th>Radicular pain at follow-up</th>
<th>Improvement of neck pain at follow-up</th>
<th>Neurologic symptoms at follow-up</th>
<th>Follow-up (mo)</th>
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<tr>
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<td>None</td>
<td>20</td>
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<tr>
<td>2 Unchanged</td>
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<td>Fair</td>
<td>Improved</td>
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<tr>
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<td>19</td>
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<tr>
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<tr>
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</tr>
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<td>Hypesthesia improved</td>
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ANALYSIS OF THE UNSATISFACTORY RESULTS

One patient with an unsatisfactory result preoperatively had symptoms for >2 years. After percutaneous nucleotomy, improvement was noted for 2 weeks; afterward, the symptoms recurred and the underwent surgery again in another hospital 6 months later. However, the follow-up indicated that his symptoms remained unchanged. The second unsatisfied patient complained about neck pain for 14 years and for nearly 4 years about radicular pain on the left side. Postoperatively, the pain had disappeared for 3 months, after which he started to have recurrent neck pain with headaches and recurring pain on the contralateral side. Further diagnostic procedures showed additional disk protrusions at two other levels. Further surgical procedures were not recommended.

DISCUSSION

The combined procedure of low-dose chemonucleolysis with the automated percutaneous nucleotomy in cervical disk herniation is a new procedure. Several investigators have now reported their initial results with chymopapain injection in cervical disk herniations. As Gomez-Castresana (4) reported on the results of chemonucleolysis by cervical disk herniations performed on 50 patients with short follow-up, the preliminary results indicated a 90% success rate. Kos (8) reported on low-dose chemonucleolysis in 10 patients with cervical disk herniation, and all procedures appeared to be successful. Bonati reported 82% good results after automated percutaneous nucleotomy of cervical disk herniation (1).

This series of 22 patients with documented cervical disk herniation resistant to conservative treatment shows amazing good results with the combined therapy. The longest follow-up is only 2½ years, but no relapses so far have occurred.

Because the procedure is minimally invasive and up to now no complications have been noted, the percutaneous approach to cervical disk herniation might become the treatment of choice in the future. Although the standard approach for disk herniation—anterior disectomy with fusion with autologous bone graft—has been reported with success rates of >90% (2,9), this procedure has a higher potential morbidity and poorer patient acceptance because of the fear of paraplegia.

REFERENCES

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