An Analysis of Cervical Discography with Surgical Verification

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This report presents the results of our study of cervical discography and the findings at operation. Cervical discography has not been previously evaluated in this manner.

Our purpose was to assess the accuracy of preoperative cervical discography and to correlate discographic and myelographic findings. The anterior surgical approach usually precludes inspection of the posterior aspect of the interspace, while the posterior approach (cervical laminectomy) affords ample opportunity to observe the disc for evidence of protrusion or osteophytes.

From June, 1958, through December, 1966, cervical laminectomy was performed on 42 patients who had previously been examined by cervical discography. In this group, 49 interspaces were inspected at operation. Pantopaque myelography was used to evaluate 36 of the 49 interspaces.

Method

With the patient supine, the skin on the right side of the neck was infiltrated with 1% procaine hydrochloride after which the skin between the trachea and the carotid artery was depressed with the fingertips of the left hand. The cervical discograms were performed in one of two ways. The interspace was reached with a 2-in. 20-gauge spinal guide needle, and a 2½ in. 26-gauge spinal needle was passed through the guide needle into the interspace. Injection was made through the 26-gauge needle. This method was preferred. In the alternative method, a 22-gauge spinal needle was passed directly into the disc and injection made through that needle.

The amount of injection was from 0.2 to 1.0 ml (usually 0.4 ml) of 50% or 90% sodium diatrizoate USP. Anteroposterior and lateral x-ray films were made after each injection. Oblique views were not routinely obtained.

Central placement of the needle is difficult, because of the small size of the nucleus. If correct placement is not accomplished, however, errors in interpretation will invariably result.

Interpretation

To establish criteria for interpretation of the discograms, all of the cervical discograms made at the Cleveland Clinic from June, 1958, through December, 1966, were reviewed. During this period, 223 patients had 561 injections of cervical discs. In six instances injection could not be completed. No diagnosis could be made in 11 cases, because of poor injection or of an inadequate discogram. A total of 550 cervical discs were actually examined by discography.

Each discogram was interpreted as one of four diagnoses: normal disc, disc degeneration, spondylosis (osteophytes), and disc protrusion.

Normal Disc (45 of 550 Cases). The sodium diatrizoate shadow in the nucleus of the disc was globular. There was no extravasation.

Degenerated Disc (221 Cases). The nuclear shadow of the disc was abnormal, with or without extravasation. When the nuclear shadow of the disc was globular with extravasation of the medium, the discogram was placed in the category of degeneration. (It is realized that persistent embryonic vascular channels could be a source of escape of medium in an otherwise normal disc.† Annular tear or degeneration may also cause extravasation. These discs were classified as degenerated in order to maintain the criteria for normal as stringent as possible.)

Degenerated Disc with Spondylosis (94 Cases). The nuclear shadow of the disc was abnormal, with or without extravasation. In either case, osteophytes were promi-
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nent (spondylosis). No disc in this group had a normal nuclear shadow; this supports the concept that degeneration of the disc precedes the formation of osteophytes (spondylosis).

Protrusion of the Disc (190 Cases). The nuclear shadow of the disc was normal or abnormal, with or without extravasation. In each case a protrusion was outlined. Protrusion from a normal disc might be anticipated after trauma. Protrusion would be more likely to occur from an abnormal disc. Examples of both types of discs were found. Pain occurred during 490 of 550 injections and was considered “reproductive” if similar to the symptomatic pain.

Extravasation of the medium occurred in 406 of 550 injections. The discographer’s interpretations of the 550 discograms were in disagreement with those of the radiologist in 193 instances (36%).

Comparison of Cervical Discography and Operative Findings

The series we are reporting in detail comprises 42 patients (26 men and 16 women) in whom 49 interspaces were evaluated by cervical discography and laminectomy. The ages ranged from 28 to 72 years, the average being 44.8 years. Two patients had received a “whiplash” injury. Two patients had each had direct trauma to the neck. Six patients had received indirect trauma such as occurs after lifting a heavy object, or a blow to the shoulder. Thirty-two patients had had no previous injury.

At operation a protrusion was found in 12 patients (12 interspaces), and all were improved postoperatively. Spondylosis was found in 24 patients (25 interspaces), 15 of whom were improved by operation. No significant pathological lesions were found in six patients (12 interspaces), and two were improved after operation.

We must acknowledge that there could be some degree of error in interpretation of findings at operation. “Significant” spondylosis may be questioned. In some instances the lesion might have been missed at operation, but, as most of the patients in the “negative-exploration” category had more than one interspace examined, such errors would have been infrequent.

Protrusions Found at Operation (12 Patients, 12 Interspaces). The discograms correctly showed evidence of protrusion in eight instances; one disc was interpreted as showing spondylosis, but not protrusion; degeneration without protrusion was interpreted in three instances.

Pain was reproduced on seven injections. There was nonreproductive pain on two injections. No pain was produced on two injections. Pain was not recorded on one injection.

Spondylosis Found at Operation (24 Patients, 25 Interspaces). The discograms correctly showed evidence of spondylosis in 12 instances. In seven instances the diagnosis made was of “protrusion.” Six discs showed degeneration without spondylosis.

Pain was reproduced on eight injections. There was nonreproductive pain in 16 injections. There was no pain on one injection.

Negative Exploration (6 Patients, 12 Interspaces). The discogram was normal in one instance. Degeneration was interpreted in six instances. Two discograms were interpreted as demonstrating spondylosis. A protrusion was demonstrated in three instances.

Pain was reproduced on six injections. There was nonreproductive pain on five injections. There was no pain on one injection.

The over-all diagnostic accuracy of the cervical discogram was 55% (27 correct diagnoses in 49 interspaces examined at operation). Only one disc in the 49 examined by discography was interpreted as normal. Four injections were painless, and one response was not recorded. Although the number of times pain was reproduced and the number of discograms indicating protrusions were about equal, there was no correlation between the two. Pain on injection was indicative of abnormality of the disc, but it was not diagnostic of protrusion.

Comparison of Pantopaque Myelography and Operative Findings

Pantopaque myelography was used to evaluate 36 of the 49 interspaces shown on cervical discograms. The results of myelography were compared with the operative findings.

Protrusions Found at Operation (6 Interspaces). In all cases a defect was noted on the myelogram. It was correctly interpreted as indicating a disc protrusion in three in-
stances. In the other three instances the defect was interpreted as demonstrating spondylosis.

_Spondylosis Found at Operation (21 Interspaces)._ A defect was noted on the myelogram in each of 19 of the 21 interspaces. The interpretation was of spondylosis in 16 instances. In three the test was interpreted as demonstrating protrusion. The other two myelograms were normal.

_Negative Exploration (9 Interspaces)._ Seven interspaces were interpreted as normal. A myelographic defect was noted in each of two interspaces and was interpreted as indicating spondylosis.

The myelograms were quite accurate. They failed in only two instances to demonstrate a significant defect in the protrusion and spondylosis categories. In two instances in the negative exploration category a defect was demonstrated that was believed to be not significant at the time of operation. The accuracy of distinguishing protrusions from spondylosis on the myelogram is less pronounced.

**Comparison of Cervical Discograms and Myelograms with Operative Findings**

The myelographic and discographic findings in the 36 interspaces were analyzed in relation to each other and in relation to the operative findings.

_Protrusion Found at Operation (6 Interspaces)._ The discograms demonstrated protrusion in four instances. The myelograms demonstrated defects in all six instances, but they were interpreted as being caused by protrusions in only three.

_Spondylosis Found at Operation (21 Interspaces)._ Defects were noted on the myelograms in 19 instances, and spondylosis was correctly interpreted in 16 instances. Spondylosis was interpreted in only nine instances on the discograms. Protrusion was the interpretation in five instances. Neither spondylosis nor protrusion was demonstrated on the discograms in seven instances, as compared with only two normal interspaces on the myelograms.

_Negative Explorations (9 Interspaces)._ The myelograms and discograms compared favorably. No defect was found on the myelograms in six instances. The discograms were interpreted as showing normal or degenerated discs in six instances. Spondylosis was interpreted by both tests in two instances. In only one instance did they disagree: a normal interspace on the myelogram, and a protrusion on the discogram.

The diagnostic accuracy of the myelograms was 72% (26 correct diagnoses in 36 interspaces examined at operation), while that of the discogram was 53% (19 correct diagnoses in 36 interspaces examined at operation). The actual number of abnormal discs demonstrated by each test was higher, but protrusion could not be distinguished from spondylosis in a significant number of instances.

**Comment**

In our experience, lumbar discography has proved to be a useful and accurate diagnostic procedure\(^3\) whereas the value of cervical discography has been less clear. The appearance of the cervical discogram, the response to injection, the low incidence of complications, the avoidance of entry of the subarachnoid space, and the low exposure to radiation have all been cited in favor of the test.\(^1,2,5,6\) The high incidence of false-positive information, the prevalence of abnormal asymptomatic cervical discs, the frequency of extravasation of dye, and the fact that all patients have pain on injection are mentioned in refutation of the value of cervical discography.\(^4,5,7\)

Much of the controversy has resulted from differences in technique in the performance of the test.\(^1,4,6,7,9\) A great deal of emphasis has been placed on the errors of a single aspect of the test.\(^8\) The proponents of cervical discography contend that, for accuracy, the clinical picture, the response to injection, and the discogram must be correlative.\(^1,2,9,10\)

The posterior approach to the interspace is of most value in the presence of a cervical disc protrusion. The difference between protrusion and spondylosis is not always resolved by myelography; nor is cervical discography infallible in this regard.

**Summary and Conclusions**

In a total discography series of 550 cases, 42 cases also had a laminectomy. We have compared the discographic and operative
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findings in those patients who had both procedures.
The following conclusions can be drawn from our study:

1. Cervical discography is a safe procedure of limited value and should only be judged in relation to the clinical picture, roentgenograms, and myelograms.

2. Abnormal discograms were frequent, partly because pathological lesions were suspected and partly due to an incorrectly eccentrically placed needle.

3. Extravasation of contrast medium occurred frequently and indicated either annular degeneration, or the presence of patent embryonic vascular channels. It had no other diagnostic significance.

4. Pain on injection is highly indicative of abnormality of the disc, but reproduction of symptomatic pain is not diagnostic of protrusion.

5. The interpretation of the discogram was difficult and led to both false positive and false negative diagnoses.

6. Cervical discography was valuable in the demonstration of degeneration of the disc. Myelography could not do this. Discograms demonstrated degeneration of the disc in all cases of spondylosis, although the degree of degeneration could not be accurately ascertained.

References


