CLEVELAND CLINIC QUARTERLY
Volume 36, January 1969

Printed in U.S.A.

The diagnostic inaccuracy of the pain response in cervical discography

LEONARD A. KLAFTA, JR., M.D.*

JOHN S. COLLIS, JR., M.D.

Department of Neurologic Surgery

THE injection of an intervertebral disk with radiopaque contrast medium, and the evaluation of the pain associated with injection constitute a diagnostic procedure known as discography. The status of the injected disk can be evaluated from the roentgenographic record thus obtained; the character and location of any pain produced on injection is believed to furnish similar information.[1, 2] The value of pain production at the time of discography in the diagnosis of the lumbar intervertebral disk is well founded.[3] However, the diagnostic accuracy of the cervical discogram is controversial, and the significance of the pain response is particularly indeterminate.[4]

An analysis was made of the pain responses to 549 cervical disk injections performed at the Cleveland Clinic Hospital in the period from 1958 through 1967. The responses to injection were considered with reference to the roentgenographic records obtained. The purpose of our study was to determine whether there was or was not a correlation between subjective response and discographic evidence.

Technic

Discography was performed with each patient supine. A subcutaneous injection of 1 percent procaine hydrochloride was administered. Deep digital pressure was applied over the appropriate interspace between the trachea and the carotid artery. One of two methods was then used. The preferred method was as follows. A 2-in. 20-gauge spinal guide needle was inserted into the outer annulus of the appropriate intervertebral disk, and a 2½-in. 26-gauge spinal needle was passed through this guide needle toward the center of the disk. Central placement of the needle was always the goal, but could not always be achieved. Roentgenograms were made to ascertain correct placement, and then injection of contrast medium was made through the needle.

The alternative method was to pass a single 22-gauge spinal needle toward the center of the disk; roentgenograms were made to ascertain correct placement, and contrast medium was then injected through the needle.

From 0.2 to 1.0 ml (usually 1.4 ml) of 50 percent (or occasionally 90 per-

* *Formerly Fellow, Department of Neurologic Surgery; present address: 68 North Chicago Street, Joliet, Illinois 60431.*

cent) sodium diatrizoate USP was injected. Anteroposterior and lateral roentgenograms were made after each injection. Responses to injections were recorded.

Discographic interpretation

The roentgenograms were interpreted as indicating one of three conditions: *normal*—the opacity of the nucleus was globular and all contrast medium was retained; *degeneration*—either the opacity of the nucleus was globular with extravasation, or the opacity was abnormal with or without extravasation; or *protrusion*—the opacity of the nucleus was globular or abnormal with or without extravasation, and protrusion was outlined.

Responses to the disk injections were interpreted in one of three ways: *pain like that of the presenting symptom, pain different from the presenting symptom,* or *no pain.*

Responses to disk injections

Of the 549 injections, pain was like the presenting symptom in regard to 121 (22 percent); pain was dissimilar in regard to 369 (67 percent); and there was no pain in regard to 59 (11 percent).

Pain like the presenting symptom—121 (22 percent). There were three normal disks (1.5 percent); 62 discograms (51 percent) showed degeneration; and 56 discograms (48.5 percent) showed protrusion.

Pain unlike the presenting symptom—369 (67 percent). There were 22 normal disks (6 percent); 222 discograms (60 percent) showed degeneration; and 125 (34 percent) showed protrusion.

No pain—59 (11 percent). There were 21 normal disks (35.5 percent); 30 discograms (51 percent) showed degeneration, and 8 (13.5 percent) demonstrated protrusion.

Summary of discograms

Of the 549 discograms, 46 (8.5 percent) showed normal disks, 314 (57 percent) degeneration, and 189 (34.5 percent) protrusion.

Normal disks—46 (8.5 percent). Pain was like the presenting symptom in regard to 3 (7 percent); pain was different from the presenting symptom in regard to 22 (48 percent), and there was no pain in regard to 21 (45 percent).

Degenerated disks—314 (57 percent). Pain was like the presenting symptom in regard to 62 (20 percent), pain was different from the presenting symptom in 222 (71 percent), and there was no pain in regard to 30 (9 percent).

Protrusions—189 (34.5 percent). Pain was like the presenting symptom in regard to 56 (30 percent), pain was different from the presenting symptom in 125 (66 percent), and there was no pain in regard to 8 (4 percent).

Of the total of 549 injections, 490 produced pain. *Table 1* summarizes the results of the responses to injections and the evidence on discograms.

Table. 1—*Pain responses compared with interpretations of 549 discograms*

Status of disk	Responses to injections, number			
	Subtotal	Pain		
		Like symptoms	Unlike symptoms	None
Normal	46	3	22	21
Degeneration	314	62	222	30
Protrusion	189	56	125	8
Total	549	121	369	59

Discussion

In 1948, Lindblom[5] reported the use of lumbar discography for diagnostic purposes. Since then the value of this procedure has been amply demonstrated and well documented.[3] According to Cloward,[1] cervical discography was first performed by Exum Walker in 1955. The technic was further developed and extensively used by Cloward.[1, 2] He grouped the pain responses into three categories:[2] discogenic, neurogenic, and cord pain.

Discogenic pain is produced by stimulation of the annulus of the disk and its surrounding ligaments. Impulses are believed to be carried from the stimulated structures by the sinu-vertebral nerve (the recurrent nerve from the spinal root ganglion and sympathetic chain which surround the disk). Pain is usually referred to the midline vertebral or scapular regions.

Neurogenic pain is produced by stimulation of elements of the nervous system. Such pain is radicular in the distribution of the stimulated nerve, but rarely extends below the elbow.

Cord pain is characterized by electric-like shocks that travel down the body, caused by direct compression of the spinal cord. Pain may be referred only to the neck, or there may be no pain on injection.

Cloward[2] does not clearly indicate the significance of discogenic pain, since discogenic pain may occur in any abnormal disk and may also occur in a normal disk after poor placement of the needle. Neurogenic (radicular) pain is obviously significant. Neurogenic and cord pain are associated with protrusions. One would not anticipate injection of a normal disk to be painful. However, Cloward[1] stated that "most patients have some pain on injection," and he notes that with injection of a normal disk the pain is referred to the back of the neck in the midline. Similar pain distribution occurs in the discogenic or cord syndromes.[2]

The frequency with which pain occurs on injection was noted by Holt.[4] In his small series of 50 normal prison volunteers, "100 percent" of disks were associated with pain on injection.

It is our belief that pain responses to be of value should be correlative to the patients' symptoms. A protrusion that compresses a nerve root should

increase the degree of compression when the disk is expanded by the injection of contrast medium, and thereby will produce the symptomatic radicular pain. A symptomatic degenerated disk should on injection produce a pain similar to the patient's symptoms, because of stimulation of the disruptured annulus fibrosis of the disk and probably its sinu-vertebral nerve. A normal disk should not be the cause of pain or symptoms; when injection causes pain (it rarely does), it should not reproduce the patient's symptoms. Therefore, we have classified responses to injection in three ways: *Pain that duplicates the symptoms*—associated with protruded or degenerated disks, which are symptomatic. *Pain that is unlike the symptoms*—this might be expected to occur occasionally in normal disks, in asymptomatic degenerated disks, or in midline protrusions that compress only the spinal cord. *No pain*—anticipated with injection of normal disks, the rare painless degenerated disk, or with midline protrusion that compresses only the spinal cord.

Reproduction of pain occurred in regard to three normal disks. The criteria devised for interpretation of normal on the discogram are so stringent as to preclude erroneous diagnosis. Therefore, the pain response was falsely positive in regard to 1.5 percent of the injections.

Pain unlike the symptoms occurred in regard to 125 (34 percent) protrusions. If reliance were placed on the reproduction of symptoms as indicating protrusion, then these 125 protrusions would have been overlooked. This degree of false-negative information would seem to be excessive.

No pain occurred in regard to 13.5 percent of the protrusions. It is conceivable that this number could be due to midline protrusions that compressed only the spinal cord. However, 51 percent of the painless disks (9 percent of the entire series) were degenerated. This would hardly attest to the rarity of the painless degenerated disk.

In the entire series, 89 percent of injections were painful. The painful responses were not always associated with abnormalities of the disks (pain on injection occurred in 55 percent of normal disks).

The following factors are among those that may be responsible for the lack of correlation. Faulty technic—correct, central placement of the needle is essential, but extremely difficult to accomplish. Eccentric placement is a frequent and often unavoidable occurrence; this not only produces an inaccurate discogram, but may also produce an erroneous pain response. Error in interpretation—the roentgenographic picture is not always unequivocal; extravasation after injection further complicates evaluation of the discogram. The cervical disk (unlike the lumbar disk) may perhaps not lend itself to evaluation by discography with present technics. Anatomic variations, which we have not investigated, may be responsible for this difference.

Summary

Pain responses in regard to 549 cervical disk injections were analyzed in relation to the roentgenographic findings. Some pain occurred in associa-

tion with 89 percent of injections. Pain on injection, similar to the presenting symptom, is of no diagnostic significance. We found poor correlation between pain responses and discograms. This could be due to: faulty technic, error in interpretation, or the fact that cervical disks, unlike lumbar disks, may not lend themselves to evaluation by discography performed by present technics.

References

1. Cloward, R. B.: Cervical diskography; technique, indications and use in diagnosis of ruptured cervical disks. Amer. J. Roentgen. **79:** 563–574, 1958.
2. Cloward, R. B.: New method of diagnosis and treatment of cervical disc disease. (Proceedings of the Congress of Neurological Surgeons, Chicago, Ill., 1960.) Clin. Neurosurg. **8:** 93–132, 1962.
3. Collis, J. S., Jr.: Monograph. Lumbar Discography. Springfield, Illinois: Charles C Thomas, Pub., 1963, 173 p.
4. Holt, E. P., Jr.: Fallacy of cervical discography; report of 50 cases in normal subjects. J.A.M.A. **188:** 799–801, 1964.
5. Lindblom, K.: Diagnostic puncture of intervertebral disks in sciatica. Acta Orthop. Scand. **17:** 231–239, 1948; also Nord. Med. **38:** 1256, 1948.