Discography and myelography in acute injuries of the cervical spine

RICHARD B. RAYNOR, M.D.
Division of Neurosurgery, Columbia University College of Physicians and Surgeons, Harlem Hospital Center, New York, New York

Nineteen patients who suffered trauma to the cervical spine that resulted in moderate to severe neurological deficit were studied by discography. In 15 cases, myelography was also performed. When both tests were done there was good correlation of results. In the four cases where only discography was performed, the lesion was accurately localized. The danger of myelography in acute cervical fracture dislocation is emphasized and the relative safety, ease, and value of discography stressed.

KEY WORDS • cervical trauma • ruptured disc • fracture dislocation • discography • myelography

Clinical Material

Nineteen patients with severe, acute injuries of the cervical spine were studied. In four cases discography only was performed at the appropriate levels, but in the other 15 cases both discography and myelography were performed. A discogram was done at the level of the fracture or dislocation when one was present, and at one or two levels above and below as indicated by routine radiographs and clinical findings. Patients with marked osteoarthritic changes at multiple levels on plain x-ray examination were not included in this series, but if the disease was principally at one or two levels that correlated with the clinical level of injury, the patients were investigated.

Technique

All patients were put in some form of traction. In most instances Crutchfield tongs were used. For discography, most patients were moved to the x-ray table while under
traction, but in severely injured patients the procedure was done while the patient was on a Stryker frame. However, it was soon realized that patients could be safely and carefully moved to the x-ray table while maintaining traction, and film quality was markedly improved. When available, an image intensifier was used to aid in needle placement in the anteroposterior plane, and needle position was checked by Polaroid x-ray films. A No. 26 3/8 in. needle was passed through a No. 21 2 1/2 in. needle into the center of the disc, and its position checked as noted above. A 3-cc Leur lock ring syringe was attached to the No. 26 needle and, with one hand exerting moderate pressure, an attempt was made to inject 1 cc of sodium diatrizoate into the disc; lateral and anteroposterior x-ray films were then taken. The disc may take the full 1 cc of contrast medium if degenerative changes are present, but this is not necessarily significant. Only if contrast medium breaks out of the confines of the interspace, or if a major posterior protrusion occurs to decrease the canal diameter, is the amount of contrast material accepted considered important.

To maintain immobilization of the cervical spine, myelography was performed with the patient prone in skeletal traction on the x-ray table.

Results

Of the 15 patients who had both myelograms and discograms, the discogram was usually the first procedure. Although initially three interspaces were often studied by discography, it soon became apparent that significant abnormalities were usually located at either the upper clinical level of neurological involvement or one interspace below it. In fracture dislocations, a discogram was done at the interspace above if clinical findings indicated a higher dermatome or myotome involved than that of the fracture. If the fracture and dermatomal involvement were similar, the next lower interspace was examined. When a fracture dislocation was present, as was the case in eight patients, no significant pathology was found at other interspaces by either discography or myelography. If a compression fracture was present, then the interspaces above and below the vertebral body frequently had pathological disc protrusions.

In the 15 patients who had both tests, 10 did not appear to have any extrinsic pressure on the spinal cord as shown by either the discogram or myelogram. However, two of these 10 did have significant disc disruption. On discography, either lateral or anterior extravasation of contrast material occurred, and early anterior interbody fusion was done for stabilization of the spine to enable mobilization of the patient shortly after the injury. In the remaining eight patients, the discograms were minimally abnormal, and the spines were deemed stable enough to allow mobilization after relatively brief periods of traction (Fig. 1).

Five of the 15 patients who had both procedures had significant posterior protrusions of disc material on the discogram (Fig. 2). At myelography, two patients had a partial and one a complete obstruction to the flow of contrast material (Fig. 2 lower left). Two patients had air myelograms showing a filling defect opposite the lesion (Fig. 3 left). Discography was indicative of a protruding disc (Fig. 3 right).

Four patients had discograms only, and three of these showed significant posterior protrusion of disc material (Fig. 4) while one had a severe fracture dislocation and disc disruption without protrusion.

Spinal cord compression, as interpreted by discographic findings, was initially confirmed by myelography. Narrowing of the anteroposterior diameter of the spinal canal by marked posterior displacement of the posterior longitudinal ligament or the presence of a large disc protrusion into the spinal canal was considered evidence of cord compression on the discogram examination (Figs. 2 upper left, 3 right, and 4).

There were no complications from discography. There was one diagnostic error when a disc protrusion was not recognized. The patient’s shoulder had not been pulled down during the x-ray and partially obliterated the contrast material. Since the neurological level was at the next higher interspace, the x-ray was not repeated nor the available film scrutinized too carefully. In retrospect the disc protrusion could have been seen.

Of the 15 patients who underwent myelography, eight had had fracture dislocations. These were all reduced by skeletal traction several days before the myelogram. Traction weight was decreased to between

Richard B. Raynor
Discography for cervical spine injuries

Fig. 1. Case 1. The clinical level of injury was C4-5. **Left**: Lateral discogram. The C4-5 interspace has been injected with 1 cc of contrast material through a No. 26 needle placed in the center of the disc. A small amount of contrast material has gone posteriorly but remains within the confines of the disc. There is no evidence of posterior disc protrusion. Part of the posterior longitudinal ligament is outlined superiorly (arrow). The majority of contrast material is anterior with a small portion extravasating outside the disc, indicating a tear in the anterior longitudinal ligament. The C5-6 interspace was also studied and was normal. **Right**: Lateral myelogram showing no evidence of extrinsic pressure on the spinal cord.

10 and 15 lbs following reduction, and this weight was maintained during the examination. Four of the five patients examined in the prone position showed some degree of redislocation during the myelographic procedure, although none changed neurologically (Fig. 5). Myelography, performed with the patient in the supine position with contrast material injected through a lateral C1-C2 spinal puncture, may obviate this complication. However, our experience with this technique is still too limited to evaluate the method and the information obtained from it in patients with cervical trauma.

**Discussion**

The neurological examination and routine x-rays of the cervical spine localize the level of the lesion within one or two segments. Discography can then be done for more precise localization by studying the appropriate levels. Although myelography allows complete visualization of the spine, the manipulation required may be hazardous. In all instances, the highest interspace corresponding to the clinical neurological findings must be studied. When a compression fracture of a vertebral body is present, the immediately adjacent interspaces above and below should be visualized. If there is a fracture dislocation, it is only necessary to visualize additional interspaces when the clinical level does not correspond to the fracture. With osteoarthritic ridging, it is advisable to study at least one level below the highest dermatomal involvement.

Discography is simple to perform and can be done with minimal equipment, if necessary. A Polaroid apparatus and image intensifier do facilitate the study. The procedure appears safe and may be performed very early. No complications were experienced in our series.

In some patients with severe neurological deficit and no evidence of fracture dislocation, acute herniation of a cervical disc has
been postulated following trauma. With the help of the discogram, this diagnosis can be made early and appropriate treatment given which may result in significant neurological improvement in selected instances.\(^6\)

Neither the distribution of pain following injection of contrast medium into the disc\(^5,8\) nor the quantity of contrast material that the disc space will accept has been of much help in diagnosing disc protrusion following severe trauma. Many asymptomatic degenerated discs will accept 1 cc of contrast material, while some diseased discs will accept little or none. The x-ray film should show disc protrusion or extravasation of contrast material and then be correlated with the clinical findings. The value of discography as a diagnostic test may be questioned unless the above criteria are followed.\(^3\)

The one situation in which the value of discography is questionable is in the patient with diffuse spondylosis that markedly narrows the spinal canal. In such a case, if any surgery is contemplated, complete myelographic visualization of the area is indicated. However, the posterior longitudinal ligament
Discography for cervical spine injuries

Fig. 3. Case 3. The patient had a fracture dislocation of C6–7 with complete loss of motor function below the C-7 root. *Left:* Air myelogram performed via a C1–2 lateral puncture. The column of air outlines the anterior margin of the spinal cord (arrow). The air shadow disappears opposite the midbody of C-6, suggesting an obstruction to the passage of air below that point since the patient is supine with head slightly lower than the feet. *Right:* Lateral discogram showing a bolus of contrast material outlining a triangular-shaped disc fragment opposite the C6–7 interspace and upper part of the C-7 vertebral body (black arrow). The posterior longitudinal ligament is outlined (arrow #2) and is displaced posteriorly. It appears to be detached from the lower body of C-6 and all of C-7. At surgery, a large free disc fragment was found in the spinal canal with some intradural protrusion through a 1 cm dural laceration.

Fig. 4. Case 4. The patient had a severe injury to the central cord, with a compression fracture of the C-6 vertebral body. *Left:* Lateral discogram at C6–7 shows fragmentation of the disc with a large piece extruded into the spinal canal posteriorly, outlined by the superior margin of the markedly irregular bolus of contrast (arrow). The posterior longitudinal ligament has been torn from the body of C-7, allowing contrast material to disseminate behind the vertebral body, as well as along some of the fracture lines in the vertebral body. *Right:* Anteroposterior discogram. The bolus of contrast material (arrows) is partially obscured by the vertebral body behind which it lies. Most of the contrast medium is to the left and is outlined by *four arrows*. The irregularity of the upper border of the bolus is again noted. There are no lateral extravasations of contrast material. At operation, a free fragment of posteriorly protruding disc material was found.

J. Neurosurg. / Volume 35 / November, 1971
in spondylosis is usually outlined by the contrast medium in discography, and an accurate picture of canal size can be obtained at the levels studied if only one or two levels are involved (Fig. 6).

If the vertebral body has been fractured and an anterior interbody fusion is contemplated, discography may supply valuable information by outlining the fracture lines and the size of bone fragments. Placement of the graft may be adjusted to make optimal use of the bone present and obtain maximum early strength of the graft. Unsuspected fracture lines may be revealed in the vertebral body that may indicate possible compromise of graft strength and suggest conservative postoperative mobilization.

Summary

Nineteen patients with major trauma to the cervical spine were studied soon after injury, 15 by both discography and myelography and four by discography alone. When both tests were done the findings correlated well with each other, but more information could be obtained from the discogram concerning the intrinsic stability of the spine. Disc protrusions can be accurately diagnosed by discography as can the status of contiguous supporting tissues both anterior and posterior to the vertebral body. This information allows a more realistic programming of treatment. It is necessary to study the actual

Fig. 6. Case 6. The clinical level of injury was at C4-5 with loss of all motor and sensory function below that level. Left: Lateral discogram. The C4-5 interspace has been injected with 1 cc of contrast medium. Some opacification of the interspace is present, indicating disc degeneration. The posterior longitudinal ligament is outlined (arrow) and slightly protrudes into the spinal canal but is intact. A tear is present in the anterior longitudinal ligament, allowing contrast material to extrude anterior to the vertebral body. Right: Lateral myelogram shows a slight posterior displacement of the contrast column at C4-5 in the region of the previously outlined posterior longitudinal ligament. The marked irregularity of the contrast medium was thought to indicate edema and possibly laceration of the spinal cord.

Richard B. Raynor
Discography for cervical spine injuries

physical level of injury and the anatomical level if this differs from the former.

Visualization of contrast material in pathological patterns usually outside the anatomical limits of the normal disc is a most important diagnostic criterion. No complications were encountered from the procedure.

Myelography gave good information about posterior or lateral disc protrusions and the status of the spinal cord. No information was obtained about the supporting structures contiguous to the vertebral body. There was a high incidence of redisplacement in those patients who had had fracture dislocations initially and were studied in the conventional prone position even though skeletal traction was maintained during the procedure.

The evidence indicates discography is a reliable and informative diagnostic procedure in acute injuries of the cervical spine.

References


Received for publication April 10, 1970.
This paper was presented at the 17th Clinical Spinal Cord Injury Conference of the Veteran's Administration, New York, New York, September 30, 1969.

Address reprint requests to: Richard B. Raynor, M.D., 850 Fifth Avenue, New York, New York 10021.