ROOT PAIN AND PARAPLEGIA DUE TO PROTRUSIONS OF THORACIC INTERVERTEBRAL DISKS*

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At the meeting of this society in New York in 1944, one of us (J.G.L.) read a paper on the differential diagnosis of intraspinal tumors and protruded intervertebral disks in the lumbar region and their surgical treatment. During the past five years, we have learned a great deal regarding the protrusion of intervertebral disks in the cervical and the thoracic regions of the spinal column. Many bizarre neurologic conditions have been found to be due to such protrusions and many patients can be benefited if proper therapeutic measures are applied before irreparable damage to the spinal cord has occurred.

The protrusions of disks in the cervical region have received a good deal of recognition, and many excellent papers have been published on the subject. Protrusions of disks in the thoracic region, on the other hand, have had little recognition. Bradford and Spurling in their book reported a case of paraparesis due to protrusion of the 4th thoracic disk. Their patient made a complete recovery following operative removal of the protruded disk.

Young of Australia reported 4 cases of protruded intervertebral disk in the thoracic region in which the diagnosis was proved at operation, and he emphasized that this lesion in the past has been given many different names. Lesions in the upper part of the region with reference of the pain to the thorax were called "pleurodynia," "intercostal neuralgia," "intercostal neuritis" and "fibrositis." When lesions in the lower part of the thoracic region produced radicular pain which projected into the abdomen and groin, intra-abdominal disease might be suspected.

In 1 of Young's 4 cases, the 3rd disk was degenerated, in 2 the 10th disk was degenerated and in 1 the 11th disk was herniated. In visiting with several neurosurgeons of considerable experience in all fields of neurosurgery including disk surgery, one of us (J.G.L.) was surprised to learn that many of them had never seen a protruded disk in the thoracic region; and one or two surgeons felt that from what they knew about the lesion, it had best be left alone.

Because of the scant consideration that protruded disks occurring in the thoracic region have received, we felt it timely to call attention to the lesion and to report the experiences at the Mayo Clinic with it.

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From 1922 through 1948 the diagnosis of protruded thoracic disk has been verified at operation at the Mayo Clinic in 17 cases. The relative incidence of cases of protruded disks in the thoracic region among all cases of protruded intervertebral disks (lumbar and cervical as well) was estimated for the 10-year period of 1939 through 1948 at the clinic. In this interval about 5500 operations were carried out for protruded intervertebral disks, and investigation disclosed that in 12 of our 17 cases the operation had been performed during these years. This gives a relative incidence of about 2 to 3 cases of protruded disks in the thoracic region per 1000 cases.

The incidence of protruded disks in the thoracic region was found to be about equal in the two sexes. There were 8 males and 9 females in our series. The occupations varied from laborer to lawyer, and from farm housewife doing heavy work to stenographer. The youngest patient in the group was 26 years old. Of the other patients 7 were in the age group from 31 to 40 years; 5 from 51 to 60; 2 from 61 to 70, and 2 from 71 to 80. The oldest patient was 73 years of age.

A rather vague and unconvincing history of trauma was obtainable in 5 of the cases and in the remaining 12 no history of trauma could be elicited. The duration of symptoms varied greatly, ranging from the shortest of 3 weeks with a story of rapidly developing paraplegia to the longest of 24 years with a history of periodic lumbago.

The symptoms and neurologic examinations varied widely, depending
on not only the level of the protrusion, but the position of the protrusion in relation to the spinal cord and roots. Fig. 1 shows the relative frequency with which protruded disks were found at the various levels in the thoracic portion of the spinal column. The position of the protrusion was found to be midline in 11 cases, midline with some lateralization in 3 and lateral in 8 (Figs. 2 and 3). This accounts for the rather frequent signs referable to the pyramidal tract with all degrees of paraplegia, and the frequency of involvement of bowel and bladder as well as sensory deficits. Signs and symptoms of paraplegia were found in 10 of the cases, and of monoplegia in 2; neurologic examination gave negative results in 5. Dysfunction of the bowel and bladder was noted in 7 cases and sensory deficits were found in 9. Radicular or generalized pain, described as ripping, burning, constricting or pulling in nature, occurred in 12 cases. Because of the protean manifestations of protruded intervertebral disks in the thoracic region it is impossible to describe a symptom complex, such as protruded disks in the lumbar region have established.

A positive diagnosis of protruded thoracic disk was made preoperatively in only 3 cases and a tentative diagnosis in a 4th. In the 3 cases routine roentgenograms of the thoracic portion of the spinal column revealed calcification (Fig. 4) of the protruded disk and in the 4th, pathologic narrowing of the interspace was noted.
Myelograms were made on all except 2 patients; these 2 had been operated on prior to 1925. Of the 15 myelograms, 13 were made after injection of iodized oil, either lipiodol or pantopaque, and all of these except 1 revealed a defect at the level of the lesion. The myelogram that failed to reveal a defect was termed an "unsatisfactory examination." The other 2 myelograms were made after injection of air; both gave positive evidence of thoracic lesions. Results of the Queckenstedt test, which is almost routinely performed prior to myelography, were recorded in 15 cases. In 9 it gave no evidence of subarachnoid block; in 3 it showed partial block and in 3 complete block. The protein content of the spinal fluid varied from 10 to 400 mg./100 cc. with an average value of 90 mg. The cell count of the spinal fluid was normal in all but 1 case, in which it was reported as 39 lymphocytes / c. mm. A diagnosis of questionable myelitis versus a questionable tumor of the spinal cord was entertained in this case. The tentative diagnosis in 17 cases was as follows: cord tumor or cord tumor suspected in 8; indeterminate intraspinal lesion in 5; protruded calcified disk in 3; protruded disk or cord tumor in 1; myelitis or neuronitis was mentioned as alternative diagnosis in 2.

Lamineectomy was performed in all cases and the protruded portion of the disk was removed in 15. Rhizotomy was resorted to in 8 of the 15 cases to facilitate mobilization of the cord. In 2 cases decompression was performed without any attempt at removal as it was felt at the time that removal would result in too much trauma to the cord.

The follow-up study in 17 cases extends from 1 month to 11 years. Postoperative results within 1 year are shown in Table 1. In some cases motor
disability, sensory deficit and pain were not present either before or after operation.

SURGERY OF PROTRUDED DISKS IN THE THORACIC REGION

Since protrusions of thoracic intervertebral disks often compress the spinal cord and since the thoracic portion of the spinal cord occupies much more of the spinal canal in the thoracic region proportionately than the cauda equina does in the lumbar region, and since the spinal cord cannot be handled with the same relative impunity that a nerve root can, adequate exposure is essential. For involvement of a single nerve root with the protruded disk lying far laterally, hemilaminectomy gives sufficient exposure. When the lesion lies in the midline and when there is motor or sensory im-

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Immediate Postoperative Results</th>
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<tr>
<td></td>
<td>Motor</td>
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<tr>
<td></td>
<td>Disability</td>
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<tr>
<td>Disability increased</td>
<td>4</td>
</tr>
<tr>
<td>No change</td>
<td>4</td>
</tr>
<tr>
<td>Some improvement</td>
<td>5</td>
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<tr>
<td>Marked improvement</td>
<td>1</td>
</tr>
<tr>
<td>Complete cure</td>
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pairment, or both, bilateral laminectomy is advisable. Usually the lesion will extend more to one side of the spinal canal than the other. This can be determined by the neurologic findings and by palpating the lesion extradurally. Laminectomy should be extended farther laterally on the side where the protrusion is more prominent so that the lesion may be approached extradurally with the least possible rotation and elevation of the spinal cord. Usually it is advisable to divide the nerve root opposite the site of protrusion on the side on which the protrusion is to be removed. If the protruded portion of the disk is large or is centrally located, it is useful to open the dura mater and divide some teeth of the dentate ligament in order to permit the cord more freedom of movement and to lessen the traction on the cord while removing the fibrocartilaginous protrusion.

When the protruded portion of the disk has been removed and the spinal cord has been thoroughly decompressed, the wound should be closed in layers without drainage. If it was necessary to open the dura mater, it should be sutured water-tight with continuous stitches of non-absorbable material and then distended with physiologic saline solution. This latter procedure minimizes the danger of postoperative hemorrhage from the congested extradural vessels usually present. Fusion or bone graft usually is not required in the thoracic region.

Early motion in bed and early ambulation are advised; the patients who were not paralyzed are out of bed in 3 or 4 days after operative removal of the protruded disk. No back support is employed.
If the patient is paralyzed, physical therapy is instituted within a few days after operation and as soon as the wound is healed (about 10 days) a regular rehabilitation program is started.

RESULTS OF SURGICAL TREATMENT OF PROTRUDED THORACIC INTERVERTEBRAL DISKS

Since many of our 17 patients had severe neurologic deficit at the time of surgical treatment, the immediate postoperative results in such cases were rather discouraging. These correspond to the results obtained in the early days when patients were operated on for protrusions in the cervical region, then called "ecchondromas." Only in the late cases were compression syndromes of the cord recognized and irreparable damage to the cord often existed prior to operation. Since the syndrome of protrusion in the cervical region has become recognized, the results of operation for protruded disks in that region have improved tremendously. We think that with the increased knowledge and understanding of the syndrome of protruded intervertebral disks in the thoracic region, the results of surgical treatment in this group of cases will improve also.

If the lesion is recognized early during the stage of irritation of the nerve root or slight compression of the cord, the protruded disk can be removed without much manipulation of the cord and the patients should obtain an excellent result. An excellent example of early recognition and cure by surgical means is the case of a woman, 33 years of age, who was incapacitated by a non-radiating pain in the middle of the back of 7 months' duration. Motions in her back were markedly limited. Her chest expansion was only 2 inches (5 cm.). A roentgenogram (Fig. 5) of the spinal column revealed calcification within the 11th thoracic interspace with extruded calcified material within the spinal canal lying posterior to the body of the 11th thoracic vertebra. The total protein content of the spinal fluid removed from the lumbar region was only 10 mg./100 cc. Myelograms were not made, but laminectomy was performed. The protruded calcified disk was removed, and thus the pressure on the spinal cord was relieved. This gave immediate and lasting relief from pain and produced no neurologic deficit.
SUMMARY

Protrusions of intervertebral disks occur in the thoracic region in about the ratio of 2 or 3 to 1000 in the lumbar and cervical regions combined. A study of the records in 17 cases of protruded intervertebral disk in the thoracic region of the spinal column failed to disclose an etiologic factor in the majority of cases; a history of trauma was obtained in only 5 cases. The duration of symptoms in these 17 cases varied from rapid progression to a paraplegic state within 3 weeks of the time of appearance to 24 years of intermittent attacks of "lumbago." The symptoms and signs varied widely depending on the size of the protrusion, its location in regard to the spinal column, and its situation in regard to the spinal cord. Tumor or degenerative or inflammatory disease of the spinal cord was considered in the diagnosis.

The diagnosis of a space-taking lesion in the majority of cases was established on myelographic examination of the spinal canal (Figs. 6 and 7).

Treatment was by laminectomy with removal of the protruded fibro-cartilage in 15 cases and decompression of the cord without removal of the
protruded portion of the disk in 2 cases. The results of surgical treatment were brilliant only in those cases in which root pain or cord compression or both were present without gross neurologic deficit. The patients who had marked compression of the cord prior to operation usually had residual symptoms or signs indicative of irremediable damage to the cord. Thus it is evident that in order to obtain better results in these cases the condition must be suspected, recognized and treated before irreparable damage to the spinal cord has occurred.

From this study we can conclude that thoracic disks do protrude, although much less frequently than those in the lumbar and cervical regions of the spinal column. When our knowledge of this type of lesion in the thoracic region is extended and we recognize and treat it early, the results should be better than they are today.

REFERENCES