Upper thoracic disc herniations have received little attention in neurosurgical and orthopedic spine literature. Twenty-seven cases of T1–2 disc herniation are mentioned in journals and textbooks; however, details of the clinical signs and symptoms, radiographic features, and treatment are available for approximately one-half of these cases. We report the symptoms and neurological findings, radiographic features, and surgical treatment of four cases of T1–2 disc herniation, review the literature, and note several unique aspects of this malady.

Summary of Cases

The clinical features of our four patients with T1–2 disc herniation and T-1 radiculopathy treated by the senior author (H.M.) are shown in Table 1. All were treated with surgery and all had resolution of their radicular pain as well as improvement in their numbness and weakness. Horner’s syndrome (oculosympathetic paralysis) persisted postoperatively in one patient who had suffered from that syndrome preoperatively. In no case was trauma a significant factor.

Radiographic Diagnoses. Radiographic diagnosis was made by using myelography and postmyelogram computerized tomography (CT) scanning in all patients. In one case, the myelogram missed the level of the disease because the contrast material was not injected at a low enough level. Fortunately, the CT scan that followed the myelogram extended downward to T-2 and clearly showed the extradural defect at T1–2. Magnetic resonance imaging was performed in one patient, as shown in Fig. 1.

Operations. In all four cases the patients underwent a T1–2 laminotomy and foraminotomy with nerve root decompression and disc fragment excision. The operation was performed in the same manner as the posterior approach used to excise a laterally herniated soft cervical disc, allowing for minor variations in anatomy due to the prominence of the thoracic transverse processes. The posterior surgical approach for lateral cervical disc herniation has been described by numerous authors including Fager9 in his well-illustrated atlas. In three of our cases, the patient was placed in the lateral position and in one case in the prone position prior to surgery. The disc fragments were sequestered in three cases and subligamentous in one.
Disc herniation at T1–2

<table>
<thead>
<tr>
<th>Age (yrs),</th>
<th>Duration/Symptoms</th>
<th>Neurological Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>69, F</td>
<td>6 wks of rt neck, scapula, &amp;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>medial arm/forearm pain;</td>
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<tr>
<td></td>
<td></td>
<td>hand numbness &amp; weakness</td>
</tr>
<tr>
<td>2</td>
<td>48, M</td>
<td>3 wks of lt neck, scapular,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>chest, &amp; medial arm/forearm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pain; hand weakness</td>
</tr>
<tr>
<td>3</td>
<td>54, M</td>
<td>3 wks of lt shoulder, scapular,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&amp; medial arm/forearm pain;</td>
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<tr>
<td></td>
<td></td>
<td>hand numbness &amp; weakness</td>
</tr>
<tr>
<td>4</td>
<td>48, M</td>
<td>10 wks of lt neck, medial</td>
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<tr>
<td></td>
<td></td>
<td>elbow/forearm pain; hand</td>
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<tr>
<td></td>
<td></td>
<td>numbness &amp; weakness</td>
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* Imaging studies obtained in Case 1 are shown in Fig. 1.

Discussion

Thoracic disc ruptures are not common. In most published series they comprise less than 1% of surgical cases involving intervertebral disc herniation (range 0.15–4.4%).1,3–5,17,18,20,21 A frequently cited article on the incidence of thoracic disc herniation was published in 1985 by Arce and Dohrmann.3 In their paper, an illustrat-

table displays the incidence of thoracic disc herniation at various levels in 258 cases reported prior to 1985. The highest occurrence rate (66%) is in the lower third of the thoracic spine (between T9–10 and T12–L1), whereas the middle third of the thoracic spine (between T5–6 and T8–9) is the second most commonly afflicted region (28%). The upper third of the thoracic spine (T1–2 through T4–5) is the least affected area (6%). Of the 17 cases of upper thoracic disc herniation listed in Arce and Dohrmann’s review, the level most commonly involved was T1–2 (eight cases). However, the authors did not in-clude four cases of T1–2 disc herniation that had been reported 12 years earlier by Murphey, et al.19 The probable reason those cases were excluded is that they were reported in a series of cervical disc herniations. The effect of adding the four cases to those listed by Arce and Dohrmann is apparent in Fig. 2, which shows a predominance at T1–2 for upper thoracic disc herniations.3,19

The C-8 and T-1 radiculopathies are similar in a num-
ber of respects; however, distinguishing features are usually found on careful neurological examination.7,19 In both instances, the patients complain of pain in the arm and forearm, usually on the medial aspect. The pain may also involve the neck, the scapular area, and the anterior, upper chest. Both C-8 and T-1 radiculopathies usually manifest symptoms of numbness and weakness in the hand. The sensory deficit produced by the C-8 root syndrome involves the fourth and fifth digits and, perhaps, the ulnar aspect of the hand. This is the same as the sensory deficit produced by the T-1 syndrome; however, T-1 radiculopathy may also produce diminished sensation in the axilla. The motor deficit resulting from C-8 radiculopathy involves the intrinsic muscles of the hand as well as the flexors and extensors of the wrist and fingers (with the excep-
tion of the musculus extensor carpi radialis and the musculus flexor carpi radialis) and, frequently, the triceps muscle. The motor deficit resulting from T-1 radiculopathy involves only the intrinsic muscles of the hand.

The T-1 radiculopathy may also be distinguished by a Horner’s syndrome (miosis and ptosis of the eye), which is not found in C-8 radiculopathy. Horner’s syndrome results from disc fragment compression in the nerve root foramen of the myelinated axons of the anterior T-1 nerve root, which have their origin in the intermediolateral cell column gray matter at T-1 and C-8.10 These preganglionic fibers exit the foramen and course a short distance with the nerve root before communicating with the sympathetic chain. The fibers ascend in the sympathetic chain to the superior cervical ganglion, where they form a synapse with the postganglionic neurons. Unmyelinated nerve fibers ascend from the ganglion in the carotid plexus to the cavernous sinus where they enter the orbit through the super-
ior orbital fissure with the ophthalmic artery. In the orbit, branches supply the radial muscle of the iris, the superior orbital muscle, and the involuntary Müller’s muscle.10 The incidence of Horner’s syndrome in our cases (one of four patients) is somewhat low compared with the

Fig. 2. Bar graph depicting the incidence of thoracic disc herniation at the upper third of the thoracic spine. The graph is based on the 1985 literature review by Arce and Dohrmann19 of 258 cases (shown in black) with the addition of four cases (shown in gray) reported in a series of cervical lesions by Murphey, et al.,19 in 1973, but not included in the review.

Fig. 1. Case 1. Magnetic resonance images. The cervical levels were labeled by the radiologist (note the C7–T1 designation), but T1–2 was not labeled, indicating the lack of suspicion of a herniated T1–2 disc at the time of the study.
incidence (five of 12 patients) in those cases reported in the literature that contain details of the patients’ neurological findings.1,2,5–12,14–16,22,24

Because T1–2 disc herniation is rare, it may be overlooked in the patient suffering from an apparent cervical radiculopathy who is examined by means of myelography and postmyelogram CT or MR imaging (for example, see Fig. 1). Any patient who has clinical signs and symptoms of a lower cervical radiculopathy should be examined at the T1–2 level in addition to the cervical levels.

Of the 27 cases of T1–2 disc herniation reported in the literature, 17 were reported as individual cases.1,2,5–12,14–16,22–32 Love and Schorn18 reported four cases, Murphey, et al.,19 four cases, and Hann,23 two cases. In 23 of the 27 reported cases, the disc ruptured laterally, producing T1 radiculopathy.1,2,5,6,22,23,24 All but one of these patients were treated via a posterior approach.23 The outcome following surgery in those cases was generally excellent in terms of pain relief and improvement in the neurological deficit, with the possible exception of Horner’s syndrome, which was not routinely addressed in the “outcome” description. The resemblance of the laterally herniated T1–2 disc to the laterally herniated cervical disc in terms of clinical presentation and surgical treatment noted in this paper is implicit in the article by Murphey, et al., in which four T1–2 cases were included in a large series of cervical cases and all were treated via a posterior surgical approach. Borges7 notes the resemblance more explicitly.

In the literature there are four reported cases of T1–2 central disc herniation that produced spinal cord compression and myelopathy.5,6,22,25 One early case was treated by laminectomy and transdural disc excision. The patient’s postoperative status was described as “fair, neurologically unchanged.”24 In two cases, the approach was via a thoracotomy.6,25 One patient’s myelopathy improved after surgery25 and the other patient, who was paraplegic before surgery, remained so afterward.6 In the remaining case of central T1–2 disc herniation, the surgical exposure was termed an “extreme lateral approach,”22 which to us seems similar to a laterolateral extracavitary exposure. The patient’s myelopathy is said to have improved postoperatively.22 Judging from these few cases in the literature, the clinical presentation and the surgical treatment of central T1–2 disc herniation resembles the usual central thoracic disc herniation.

References

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