Surgical treatment of 63 cases of conjoined nerve roots

JAMES G. WHITE III, M.D., TIMOTHY A. STRAIT, M.D., JOSEPH R. BINKLEY, P.A., AND SAMUEL E. HUNTER, M.D.

Department of Neurosurgery, University of Tennessee Center for the Health Sciences, Memphis, Tennessee

The operative results of 63 cases of lumbar disc disease with surgically confirmed conjoined nerve roots are reviewed. The first 55 patients were treated by standard hemilaminectomy and discectomy, with only 30% reporting a good result. Of the last eight patients treated by hemilaminectomy, pediculectomy, and discectomy, seven patients returned to work. The rationale for and the technique of pediculectomy are discussed in detail. Clinical, radiological, and surgical clues indicating the presence of the conjoined nerve root anomaly are reviewed.

Key Words: conjoined nerve root, lumbar disc, discectomy, pediculectomy, secondary axilla, pedicle

Abnormalities of spinal nerve roots have been recognized by anatomists since normal nerve configurations were first described. Cannon, et al., described three varieties of lumbar nerve root anomalies that were observed during lumbar disc operations. The conjoined nerve root represented the most common variant. Their report stressed the importance of recognizing these anomalous nerve roots, and conceded the almost universally poor results with hemilaminectomy and discectomy in the management of patients harboring a ruptured disc plus a conjoined nerve root.

The purpose of this report is twofold. First, to delineate clinical, radiological, and surgical clues that indicate the presence of these anatomical variants. Second, and more important, to recommend an effective operative technique for the treatment of the conjoined nerve root anomaly. It is proposed that this technique, which represents a radical departure from standard therapy, will improve the prognosis in a previously difficult problem.

Summary of Cases

Clinical Material

The charts of 63 patients with surgically confirmed conjoined nerve root anomaly were reviewed. These included the five patients originally reported by Cannon, et al., in 1962. The case histories, preoperative diagnoses, radiological diagnoses, surgical reports, and postoperative visits were reviewed. The degree of disability as recorded in the medical record was noted. It was found that all cases were followed for at least 6 months, and a large proportion were followed at various intervals for several years. The first 55 patients were treated surgically with a standard hemilaminectomy and discectomy. The last eight patients in the series underwent surgery in a manner to be described.

Illustrative Case Reports

Case 1. This obese 28-year-old woman injured her back at work and developed radicular pain running into the right leg. Physical examination revealed a decrease to pin prick in the right L-5 and S-1 dermatomes, with a decreased right ankle jerk. She had a positive straight-leg raising test on the right. Myelography revealed an L5-S1 conjoined root on the right (Fig. 1). The patient underwent an L-5 discectomy and an S-1 pediculectomy. She returned to work in 4 months with complete relief of her pain.

Case 2. This 54-year-old industrial mechanic had a 1-year history of pain in his left leg. He had low-back pain and numbness in the dorsum and lateral aspect of his left foot. Physical examination revealed a negative straight-leg raising test bilaterally, and no sensory, motor, or reflex changes. Myelography was not performed. Surgical exploration revealed a bulging
Surgery for discs with conjoined roots

FIG. 1. Case 1. Metrizamide lumbar myelogram, anteroposterior (left) and lateral (right) views, showing an L5–S1 conjoined nerve root anomaly on the right. The dural sheath where the roots converge is broader than usual.

disc beneath an L5–S1 conjoined nerve root, and an S-1 pediculectomy with an L-5 discectomy were performed. The patient returned to work in 3 months with marked improvement in his pain.

Case 3. This 42-year-old woman with a long history of arthritis now suffered from lumbosacral pain and left sciatica. The patient had a positive straight-leg raising test on the left. She had a weak left extensor hallucis longus and hypalgesia in the L5–S1 dermatome on the left. Myelography revealed an L5–S1 conjoined nerve root (Fig. 2). At surgery, a bulging disc was observed beneath an L5–S1 conjoined nerve root; S-1 pediculectomy and L-5 discectomy were performed. The patient returned to work 3 months postoperatively, with complete relief of discomfort.

Operative Technique

Patients were prepared for standard hemilaminectomy either in the prone or lateral position. Most simple discs were approached with the patient in the lateral position. Through a midline lumbar incision, the paraspinal musculature was stripped from the underlying lamina in a subperiosteal fashion. The ligamentum flavum was excised by sharp dissection after a partial hemilaminectomy was performed. The nerve root anomaly as well as the appropriate intervertebral disc were exposed and isolated.

If the nerve root anomaly was not suspected preoperatively, then several clues may alert the surgeon to its presence. Any root that is difficult to mobilize medially when approaching a ruptured disc deserves additional lateral exposure, even if this requires a complete facetectomy, for evaluation of its anatomy. Any root arising at a less acute angle from the dura than normal, even approaching 90°, suggests the possibility of it being a component of either a conjoined nerve root or a transverse root anomaly. With additional exposure, the common dural sleeve should become easily identifiable. In most cases, a ruptured or protruded disc lies immediately beneath the common dural sleeve of the conjoined nerve root.

It is hazardous to proceed directly to discectomy at this point. The close approximation of the conjoined nerve root complex to the intervening pedicle makes it virtually impossible to mobilize it without injuring the nerve roots. To fully decompress this anomaly, a Hall diamond burr drill was employed to remove the pedicle until it had become flush with the corresponding vertebral body (Fig. 3). The roots were then easily mobilized. The disc was removed, and the danger of injury to the conjoined root was no greater than when mobilizing a single root.

Operative Results

Of the first 55 patients treated with hemilaminectomy and discectomy, the results were almost uniformly poor, with only 30% able to return to their previous employment. Of the last eight patients treated with hemilaminectomy, pediculectomy, and discectomy, seven patients returned to their previous
FIG. 2. Case 2. Metrizamide lumbar myelogram, anteroposterior (left) and lateral (right) views, demonstrating an L5-S1 conjoined nerve root anomaly on the left. The conjoined nerve roots take off from the dura at a level midway between the mirror-image roots.

The eighth patient was subsequently found to have multiple sclerosis and has been hampered by her concurrent disease process.

Discussion

As described originally by Cannon, et al., a conjoined nerve root is composed of two adjacent root sleeves sharing a common origin from the dura mater. These roots will separate after a short course to emerge through their respective foramina. One important anatomical observation is that this bifurcation closely approximates the intervening pedicle. The bifurcation of the conjoined nerve root is referred to as the "secondary axilla" (Fig. 4). The topographical relationship between the secondary axilla and the intervening pedicle plays a role in the pathogenesis of neuropathy, and underlies the rationale for pediculectomy. Removal of the pedicle prevents excessive surgical trauma that can occur from attempts to extract a ruptured disc from beneath the fixed conjoined nerve root. In addition, the caudal branch of the conjoined root is no longer vulnerable to the irritative effects of being snubbed around the pedicle.

As discussed by Agnoli, these anomalies alone should not be considered a causative factor in low-back pain and sciatica. The vast majority of these patients present following a ruptured disc with physical signs corresponding to the appropriate dermatomes. Many times, both dermatomes of the conjoined roots are involved and, if so, the surgeon should always include this anomaly in the differential diag-
Surgery for discs with conjoined roots

FIG. 4. Artist's drawing illustrating the anatomy of the conjoined nerve root anomaly. The close approximation of the bifurcation (secondary axilla) to the intervening pedicle is noted.

nosis of twin dermatomal involvement. This phenomenon should not be confused with the multiple dermatomal involvement of the cauda equina syndrome, although the two can certainly coexist. We still propose that a hint of a possible nerve root anomaly is a negative Lasègue's sign in a patient with radiculopathy. In this series, 40% of the patients with documented disc ruptures plus conjoined nerve roots had a negative test. This is in contradistinction to the findings of Bouchard, et al., who did not find the negative Lasègue's sign helpful in their series of 12 patients. No explanation for the negative straight-leg raising test is immediately apparent to us.

Bouchard, et al., clearly outlined how a radiological diagnosis of conjoined nerve roots could be made preoperatively. The criteria included the following findings: 1) asymmetry of the root sleeves; 2) presence of a broader dural sheath where the roots converge from the dura; and 3) the (conjoined) nerve root taking off at a level midway between the mirror-image roots. We have found these radiological criteria very worthwhile, but recommend the addition of metrizamide myelography to the diagnostic protocol.

The authors who have addressed the incidence of the conjoined nerve root have agreed that the L5–S1 nerve roots are most frequently involved. The L5–S1 conjoined nerve root was the most common anomaly in our series. Previous studies have pointed to the rarity of the conjoined nerve root anomaly. In our 25-year series of 4726 disc operations, a total of 63 conjoined nerve roots were identified unequivocally, for an incidence of 1.3%. It is probable that, due to the scanty descriptions of this anomaly in the past, many conjoined roots have been unrecognized and considered only as technically difficult operations with poor results.

Summary

The conjoined nerve root anomaly is described. The pathogenesis of neuropathy is attributed to the close approximation of the bifurcation (secondary axilla) of the conjoined root to the intervening pedicle. A new operative technique involving pediculectomy to decompress this anomaly is described. Clinical, radiological, and surgical clues to diagnosis are reviewed. The incidence of the conjoined nerve root anomaly is probably near 1.3%. Recognition of this anatomical variant should lead to successful treatment.

References


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Address reprint requests to: James G. White III, M.D., Department of Neurosurgery, University of Tennessee Center for the Health Sciences, 956 Court Avenue, Memphis, Tennessee 38163.