

Accidental Finding of an Anomalous Spinal Nerve Root during Lumbar-Disc Surgery: A Case Report and a Review of Literature

Karlo Houra, Vili Beroš, Damir Kovač, Tomislav Sajko, Živko Gnjidić and Krešimir Rotim

Department of Neurosurgery, »Sestre milosrdnice« University Hospital, Zagreb, Croatia

ABSTRACT

Anomalies of lumbosacral nerve roots, even though are rare, have been well documented so far in the medical literature. The early diagnosis of these anomalies may be difficult and it is crucial to develop specific methods for depicting them. Preoperative diagnosis of anomalous lumbosacral spinal nerve roots using the magnetic resonance imaging is essential to facilitate thorough surgical planning in order to avoid unnecessary complications for the patient during surgery. The operative management of these anomalies depends on the patient's neurological problems and while asymptomatic and accidentally diagnosed cases do not require treatment, patients who suffer low back or sciatic pain need surgical intervention in order to decompress nerve roots. We report a 45-years old woman presented with severe low back pain associated with left lumboischialgia. Intraoperative finding of an aberrant L5/S1 nerve root, optimal surgical therapy and different classifications are discussed together with a review of literature.

Key words: nerve roots, anatomical anomaly, lumbosacral spinal cord

Introduction

Anomalies of lumbosacral nerve roots have been well documented so far in the medical literature. Related studies on this topic, some based on anatomic investigations and other based on operative findings, have reported the incidence of nerve roots anomalies in lumbosacral region to range from 0.34% up to 14% in general population, but also in patients diagnosed and operated with lumbar disk herniations¹. Zagnoni² in 1949, was the first to report an anatomical description of an anomalous nerve root. Subsequently Ethelberg and Riishede³, Fineschi⁴, Reynolds⁵ and Deyerle and May⁶ described similar cases. In 1962 Cannon et al.⁷ proposed the first classification of nerve root anomalies. Other classifications have been proposed by Postacchini et al.⁸, by Kadish and Simmons⁹, by Kikuchi et al.¹⁰ and the last one in 1992 by Chotigavanich and Sawangnatra¹. The roots most frequently involved by the anomaly are L5 and S1, accounting for 50% of the total number of this kind of anomalies¹¹. Multiple malformations may be frequent and the majority of them, for the unknown reason, occur on the left side which also showed to be true in our patient. The

early diagnosis of these anomalies may be demanding and it is crucial to develop more sensitive and specific methods for demonstrating them. In fact, a correct diagnostic approach is fundamental in order to avoid hazardous errors and to allow safe and correct surgical approach to the patient, if one is needed, thus guaranteeing proper management of these disorders in order to minimize possible patient's intraoperative complications.

Case Report

A 45-years old woman was admitted at our Department of Neurosurgery complaining of a severe low back pain associated with left lumboischialgia. The symptoms did not improve after 6 months of conservative therapy including limitations of activity, medication, and physical therapy. On examination, the patient exhibited guarded spinal motion and paralumbal spasm. A positive left Lasegue sign on 35 degrees, and negative Lasegue sign on the right side, weakness of left plantar and dorsal

flection (Grade 4/5) and a decrease in the left Achilles response were noted. Axial computed tomography (CT) imaging study revealed eccentric left-sided herniated disc with the obliteration of lateral recess compressing the left nerve root and dural sac in the L4-L5 intervertebral space. The same finding of herniated disc was noted in the left lateral recess one level below. Because of severe and continued pain in the left lower extremity together with epidural pathology consisted with patients symptoms, surgical intervention was indicated.

Using the X-ray for the exact verification of L5-S1 intervertebral disc space, we performed a left sided interlaminectomy in standard fashion. After thorough microsurgical dural sac preparation we were unable to find the S1 spinal nerve root and its exact point of emergence from the dural sac. Given the finding on the CT scan, and necessity to remove herniated disc at the above level, the same procedure was repeated at the L4-L5 intervertebral disc space where we found one tick, conjoined spinal nerve root exiting the dura (Figure 1). This common

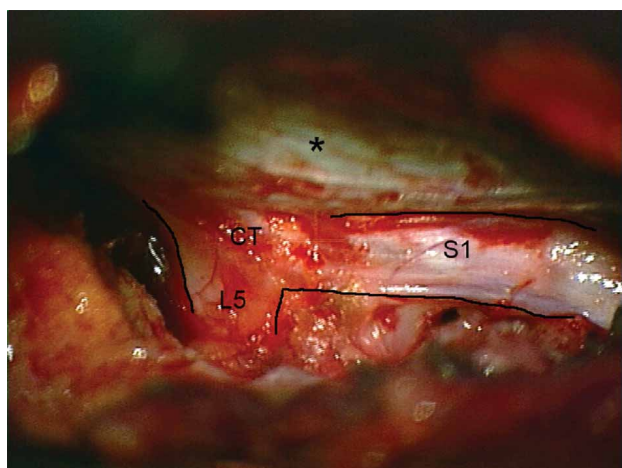


Fig. 1. Intraoperative photo showing anomalous emergence of the aberrant L5/S1 spinal nerve root in which conjoined roots (outlined in black) emerge as the common trunk (CT) from the dural sac (marked with asterisk) and after a short course branch to a thinner, transversely coursing, nerve root L5 and a thicker, caudally coursing, nerve root S1.

nerve trunk bifurcated after a course of 5 millimeters into one thinner, transversely running, nerve which later showed to be L5 and into other, thicker, nerve root running in the normal caudal direction. The later was an aberrant first sacral spinal nerve root that was missing on the lower L5-S1 level. Given the significant disc protrusions the discectomy was performed on both levels in order to decompress spinal roots. Postoperative course was uneventful and the patient reported significant relief of the left lower extremity radicular pain. Her neurologic deficits resolved promptly after surgery and she was discharged home on the 7th postoperative day. Five years have passed now since the surgery and she does not have any complains of radicular or lower lumbal back pain what so ever.

Discussion

Numerous reports of lumbosacral nerve root anomalies are described in the literature. These anomalies were assessed on the basis of operative findings, neuro-radiologic examination and autoptic studies^{7,9,12,13}. Level L5-S1 is most commonly involved.

MRI is able to demonstrate the right appearance of the anomalies thus permitting a correct planning and management of the different cases. Even though CT scan can be used to depict spinal pathology, sometimes it is insufficient in differentiating delicate soft tissue structures, what was the case with our patient. Conjoined nerve roots and an associated enlargement of the lateral recess may be often confused with a dumbbell tumor or a free fragment of an extruded disk on CT scans. MR imaging is by far a better diagnostic procedure (in comparison to CT) for the differentiation of nerve root anomalies and, in particular, coronal sections furnish a precise definition of the profile of the conjoined/enlarged rootlets¹². The accurate information derived from MRI of multiple planes may be priceless for the preoperative and diagnostic evaluation of lumbosacral nerve root anomalies.

Preoperative diagnosis of such anomalous lumbosacral nerve roots using the magnetic resonance imaging is therefore essential to facilitate thorough surgical planning and prevention of unnecessary complications for the patient. Many reports have stressed the danger of potential injury to anomalous nerve roots during surgery as well as possible failure to relieve symptoms if the abnormality is not properly addressed¹⁴. Anomalous nerve roots should be suspected in failed operations for herniated disc lesions and knowing the various types of such anomalies therefore might improve the success rate of spinal operations considerably.

The embryology of these root anomalies still remains uncertain. The malformations in which the nerve roots emerge at a more caudal level, or in closely adjacent dural openings, or in a common nerve trunk, probably result from defective migration of the roots during the embryonic development, pending the usual unilateral occurrence of these anomalies¹⁵. The emergence of roots at a more cranial level and the bilateral anomalies of one or more roots are probably due to an abnormal emergence of the affected roots from the spinal cord⁸.

From a clinical viewpoint, anomalies and malformations of lumbosacral nerve roots and their coverings usually do not initially produce any symptoms. It is only when further degeneration of disks and/or vertebral joint occurs (often accompanied by stenosing of the spinal canal and of the root canal entrance) that clinically relevant root compressions may be observed¹⁵.

It has been suggested that pain associated with anomalous nerve roots is caused by several factors¹. First, the anomalies themselves may somehow cause the symptom; second, because anomalous roots occupy most of the space in intervertebral foramen, even a slightly bulging intervertebral disk or swelling of the nerve root may cause noticeable pain. And third, traction symptoms

could be created in anomalous roots even with normal spine movements.

Various classifications of an anomalous nerve roots have been proposed in the medical literature by different authors. Four of them are discussed as follows. In 1962 the first classification was proposed by Canon et al.⁷ in which there are three main types of nerve root anomalies. Type I: conjoined (or confluent) type, in which 2 roots share a common sleeve that originates from the dura mater. Type II (anastomotic type) in which a normal root bifurcates abnormally after it leaves the dura and branches out to the next caudal nerve. Type III (transverse type) in which the nerve root leaves the dural sac at almost a right angle. Postacchini et al.⁸ proposed another classification based on 5 different types. Type I: one or more roots emerge at an abnormal cranial level. Type II: one root emerges at a more caudal level than normal. Type III: two or more nerve roots emerge through closely adjacent openings of the dura. Type IV: two nerve roots emerge from the dural sac in a common nerve trunk. Type V: an anastomotic branch connects two nerve roots in their extrathecal course. Kadish and Simmons⁹ classified 4 types of anomalies. Type I: intradural anastomosis between rootlets. Type II: anomalous origin of nerve root, including: a) cranial origin; b) caudal origin; c) combination of cranial and caudal origin affecting more adjacent roots; d) conjoined nerve roots. Type III: extradural anastomoses between nerve roots. Type IV: extradural division of the nerve roots. According to Chotigavanich and Sawangnatra¹ there are six fundamental types of nerve root anomalies. Type I: Intradural anastomosis between rootlets at different levels. Type II: Extradural anastomosis between nerve roots. Type III: Extradural division of the nerve root. Type IV: Intradural anastomosis between rootlets and extradural division of the nerve root. Type V: Intradural and extradural division of nerve root. Type VI: Closed adjacent nerve roots.

Taken all these classifications into consideration, our patient can be classified as Type I according to Canon, Type II according to Kadish and Simmons, Type III according to Chotigavanich and Sawangnatra and Type IV according to Postacchini. As one can see, all of these classifications are somehow similar, but also different at the same time emphasizing their mainly academic rather than clinical importance.

The operative management of these anomalies depends on the neurological problems and the clinical conditions existing in each individual case¹⁴. Asymptomatic

and accidentally diagnosed patients do not require treatment since anomalous nerve root itself is not an indication for the operation. Intervertebral disk herniations associated with root anomalies, with or without conjoined bony alterations, have to be treated in order to relieve neurological signs and symptoms. In these cases, an adequate exposure of the nerve roots involved to avoid persistent compression as well as to reduce any traction may be necessary.

According to previously mentioned classifications, all of these lumbar spinal nerve root anomalies can be roughly divided into intradural and extradural ones and this simple criterion is, to our opinion, the most important in everyday neurosurgical practice.

From the neurosurgical point of view the extradural, mainly those with abnormal branching and conjoined dural origin, are the most important malformations of the spinal nerve roots. Given the fact that vast majority of them are incidental findings that are not clearly visible on MR or CT scans previous to the surgery, and the fact that annulus fibrosus of the herniated lumbar disc is most often surgically incised laterally in the spinal canal, neurosurgeon should be very careful during the surgical procedure and anatomical preparation of the dura not to injure the aberrant nerve root which might be positioned abnormally in the lateral wall of the spinal canal. During the lumbar-disk operations therefore, when one identifies a single nerve root exiting the dura, he should still be very cautious to thoroughly examine the lateral recess and the remainder of the spinal canal before he does the disc incision, in order to prevent the accidental injury to possible anomalous nerve root.

Unlike some authors suggested¹⁵, we think that appropriate decompression can be achieved with interlaminectomy rather than hemilaminectomy in order to avoid the alterations of stability and to ensure correct mobility of the lumbosacral spine. The sufficient exposure of the intervertebral foramen or of the lateral recess, in our opinion, can be easily achieved with interlaminectomy and even in the presence of nerve root anomalies a wider exposure such as hemilaminectomy is not necessary.

In conclusion, these uncommon, but well known, anomalies of the spinal nerve roots may be successfully treated, if necessary, as long as correct diagnosis, clinical and prognostic evaluation, surgical planning and management have been carefully performed.

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K. Houra

*Department of Neurosurgery, »Sestre milosrdnice« University Hospital, Vinogradska 29, 10000 Zagreb, Croatia
e-mail: khoura@kbsm.hr*

SLUČAJNI NALAZ ABERANTNOG SPINALNOG KORIJENA TIJEKOM OPERACIJE LUMBALNOG DISKA: PRIKAZ SLUČAJA I PREGLED LITERATURE

S A Ž E T A K

Anomalije lumbosakralnih korijena spinalnih živaca, iako rijetke, u medicinskoj su literaturi dobro opisane. Ranu dijagnozu ovih anomalija ponekad može biti teško postaviti te je stoga vrlo važno razviti specifične metode kojima bi se navedene anomalije mogle adekvatno prikazati. Preoperativno korištenje magnetske rezonance u dijagnosticiranju anomalija spinalnih živaca važno je radi izrade temeljitog kirurškog planiranja s ciljem izbjegavanja nepotrebnih komplikacija. Operativno zbrinjavanje bolesnika s ovim anomalija ovisi o njihovom neurološkom statusu pa oni bolesnici koji su asimptomatski ili kod kojih je anomalija nađena slučajno, ne zahtijevaju operaciju, a kod simptomatskih bolesnika koji se žale na lumboischialgiju izvode se kirurški zahvati s ciljem dekompresije stisnutog korijena živca. U radu smo prikazali slučaj 45todišnje bolesnice koja je došla na operaciju radi višemjesečne ljevostrane lumboischialgije. Kod navedene je bolesnice intraoperativno nađena anomalija korijena spinalnog živca L5/S1. Opisali smo adekvatni kirurški tretman, podjelu anomalija živčanih korijena i pregled dostupne literature.