New Procedures in Spinal Interventional Neuroradiology
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Spinal Canal Stenosis

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Luigi Manfrè
Editor

Spinal Canal Stenosis

Springer

Editor
Luigi Manfrè
Minimal Invasive Spine Therapy
Cannizzaro Hospital
Catania, Italy

Electronic supplementary material is available in the online version of chapter 2 on SpringerLink: http://link.springer.com

ISBN 978-3-319-26268-0 ISBN 978-3-319-26270-3 (eBook)
DOI 10.1007/978-3-319-26270-3

Library of Congress Control Number: 2016938231

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG Switzerland

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Imaging and Symptoms of Spinal Canal Stenosis

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Cosma Andreula, Gianpiero Berardi, and Alessandra Tripoli

Spinal canal stenosis is a *unisegmental* or *polysegmental* narrowing of the central spinal canal and/or of the lateral recesses and/or of the root canals which can lead to nerve roots or spinal cord compression. This condition is more common in the cervical and lumbar tracts.

Patients with cervical spinal stenosis have insidious onset symptoms, characterized by uni- or bilateral radiculopathy or myelopathy, (e.g., gait disturbance progressive paraparesis related, dysesthesias). Cervical pain is often associated with spinal canal strictness and constriction, but it is not specific. In particular, cervical stenosis may be limited to a simple radiculopathy, with radicular pain, which radiates along the corresponding dermatome, combined with acute painful crisis and functional limitation of neck flexion (Fig. 1.1).

Sometimes, though, the stenosis can bring to a slow and progressive compression in the spinal cord, in the small medullary vessels, and also in the anterior spinal artery (which supplies blood to the anterior two-third of the spinal cord).

Thus was the true myelopathy which is characterized by a clinical picture that, in most cases, can be described as follows: after a long period of painful radicular paresthesias in neck (with functional limitation of the neck), shoulder, and upper limb, caused by neck movements (radicular pains phase), autonomic disorders appear due to cervical sympathetic pain (hyperhidrosis, hypothermia, edema) and disorders of movement both sympathetic and peripheral.

Generally, the former are in the lower limbs and can even bring to spastic paraplegia (impairment of the pyramidal system); the latter, the peripheral ones,

C. Andreula, M.D. (✉) • A. Tripoli
Unit of Radiology and Neuroradiology, Anthea Hospital, Bari, Italy
e-mail: cosma.andreula@gmail.com

G. Berardi
Unit of Radiology, The Accredited Private Hospital S. Maria, Bari, Italy

L. Manfrè (ed.), *Spinal Canal Stenosis*, New Procedures in Spinal Interventional Neuroradiology, DOI 10.1007/978-3-319-26270-3_1

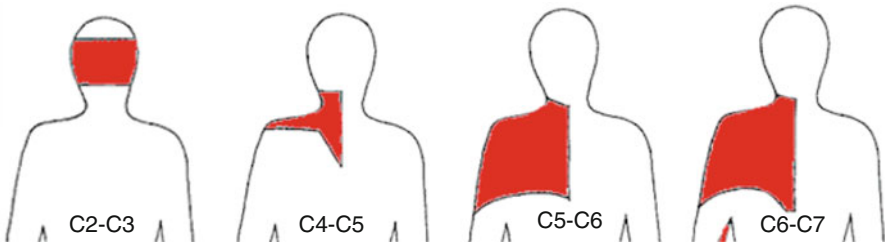

Fig. 1.1 Cervical dermatomes

consisting of hypomuscular atrophies and absence of proprioceptive reflexes, are located in the upper limbs.

There are also lateralized thermodolorific hypoanesthesia (compression on the backs of a spinothalamic bundle) and sphincter disturbances [1–4].

Sometimes, the myelopathic picture is that of a half section of the spinal cord, like Brown-Sequard syndrome, with spastic paralysis (lesion of the pyramidal tracts) and abolition of deep sensitivity, tactile epicritical (lesion of the posterior column), ipsilateral to the lesion, thermal anesthesia, and pain contralateral to the lesion and total anesthesia (radicular lesions or posterior horns) ipsilateral to the lesion, with hyperesthesia over the lesion (lesion of spinothalamic tracts).

But it is also possible to observe clinical patterns of *medullary transverse section* characterized by complete flaccid paraplegia/quadriplegia, pronounced muscular hypotonia, cutaneous and tendon reflexes absence, global sublesional anesthesia, fecal and urinary retention, impossibility of erection and ejaculation, trophic changes of the skin and muscles, absence of sweating, and vasomotor paralysis with arterial hypotension and hypothermia. An accurate early diagnosis is essential, since there is no spontaneous regression of the process and the surgery prevents the progression of symptoms. The stenosis *below* the level of the *conus medullaris* can manifest in many symptoms due to the compression of a single root or the cauda equine and causes pain (at the site of the stenosis and/or irradiated in the limbs), with possible sensory and/or motor deficits. Obviously, the clinical pattern will depend on the extent and on the level of stenosis itself. Since the spinal cord usually ends at the level of the lower border of the vertebra L1, the lumbosacral roots, to reach the foramen where they exit from the spinal canal, must move downward obliquely, touching anteriorly with the intervertebral disks, with the interposition of the posterior longitudinal ligament. So it is clear that if the stenosis involves only the intervertebral foramen, it will compress the roots with the name of the lower vertebra, but if it also leads to a reduction of the anteroposterior diameter, it can also compress one or more underlying roots [1–4] (Fig. 1.2).

So the pain can be either root or spinal. Radicular pain is generally of sciatica type since it is linked to the compression of the roots that give rise to the sciatic nerve (L5, S1, S2, etc.), but can also be a cruralgia type in cases where also L4 root, a root that gives rise to the femoral nerve, is compressed.

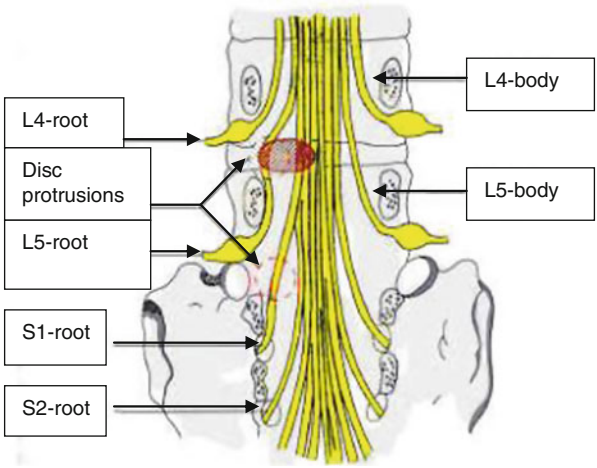

Fig. 1.2 In the lumbar tract radicular compression can involve the foramen or the underlying roots of the cauda

Radicular pain is localized in the site of innervation of the compressed root; generally it is not continuous and can be exacerbated by situations that accentuate the compression or stretching of the same root; typically, upright position with the straight leg, coughing, sneezing, and straining are all situations that result in an increase in CSF pressure resulting in higher compression on the nerve roots.

The Lasègue sign, in patients with lumbar canal stenosis, is positive in both phases; particularly pain is evoked with the patient supine, both during flexion of the thigh on the pelvis to leg extended, both during flexion of the thigh on the pelvis bent leg. The extent of root compression determines the extent of pain within the dermatome and then the different degree of positivity of the Lasègue sign. The intensity of the pain varies according to the degree of extension of the leg on the thigh.

The pains of the spine are localized, instead, in the lumbosacral region (low back pain); they don't have a provision root, are exacerbated by finger pressure exerted in the paravertebral site (signs of Delitala, Lasègue, and Valleix), in correspondence of the intervertebral disk, and are often associated with stiffness of the lumbar spine, with obvious limitation of any movement of the trunk [1–4]. The lumbar spine is stiff, the back muscles are contracted. In the upright position, the pelvis is tilting towards the healthy side with compensatory and analgesic scoliosis. From a pathophysiological point of view, low back pain is the clinical expression of the stretch of the peripheral portion of the fibrous ring that along with other structures (such as the posterior longitudinal ligament, capsular ligament structures of the vertebral joints, etc.) is innervated by branches of breast – spinal nerve Luschka.

The typical symptoms of stenosis are therefore a direct result of the compression of the spinal roots and can affect one or both legs. The main symptom is pain in the legs that is frequently associated to low back pain.