NCBI Bookshelf. A service of the National Library of Medicine, National Institutes of Health.

StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019 Jan-.

Anatomy, Back, Lumbosacral Trunk

Authors

Mohammed A. Miniato[1]; Matthew Varacallo[2].

Affiliations

[1] University of Toledo/College of Med.
[2] Department of Orthopaedic Surgery, University of Kentucky School of Medicine

Last Update: March 9, 2019.

Introduction

The lumbosacral trunk consists of a combination of ventral rami of the fourth and fifth lumbar nerve roots that join with S1 nerve fibers contributing to the sacral plexus. The lumbosacral trunk contributes to the innervation to the muscles of the posterior thigh, lower leg, and foot via the sciatic nerve, superior gluteal nerve, inferior gluteal nerve, nerve to obturator internus and superior gemellus muscles, and the nerve to quadratus femoris and inferior gemellus muscles.

Structure and Function

The lumbosacral trunk is a collection of neural fibers that interconnect the lumbar and sacral plexus. The lumbosacral trunk consists of the entire anterior segment of the fourth and fifth lumbar nerves. These nerve fibers run on the medial side of the psoas major muscle and run inferiorly over the pelvic brim to join the first sacral nerve. The lumbosacral trunk gives rise to the following nerves:

- Sciatic nerve
- Superior gluteal nerve
- Inferior gluteal nerve
- The nerve to internal obturator and superior gemellus muscles
- The nerve to quadratus femoris and inferior gemellus muscles

Embryology

The neural plate forms during the third week after fertilization and creates the neural tube and neural crest cells. The neural crest cells become peripheral nerves, including the nerves of the lumbosacral trunk. Schwann cells also derive from neural crest cells and myelinate nerves in the peripheral nervous system.

Blood Supply and Lymphatics

Blood supply of peripheral nerves comes intrinsically from the vasa nervorum within the epineurium and extrinsically from parallel running arteries.

Nerves

Sciatic nerve[1]:

The sciatic nerve is the largest nerve in the body and forms from the conglomeration of fibers from L4 to S3 that then course deep to the piriformis before passing through the greater sciatic foramen to exit the pelvis. It travels down

the posterior thigh through the popliteal fossa, where it splits into the tibial nerve and common peroneal nerve.

Superior gluteal nerve[2]

Formed by the dorsal fibers of L4 to S1, it leaves the pelvis via the greater sciatic foramen and is the only nerve to exit via this foramen above the piriformis. Tracking along with the superior gluteal artery and vein, it innervates the gluteus medius and gluteus minimus along with the tensor fascia lata.

Inferior gluteal nerve[3]

Arising from the dorsal branches of L5 to S2 leaves the pelvis via the greater sciatic foramen running under the piriformis before branching into and supplying the gluteus maximus.

The nerve to internal obturator and superior gemellus muscles

Formed from L5 to S2 fibers, it exits the pelvis via the greater sciatic foramen to supply the muscles in its name.

The nerve to quadratus femoris and inferior gemellus muscles

Formed from L4 to S1 fibers, it descends along the ischium and posterior to the hip joint before supplying the quadratus femoris and inferior gemellus.

Muscles

Sciatic Nerve[4][5]

The sciatic nerve innervates the posterior thigh, including the biceps femoris, semitendinosus, semimembranosus, and the ischial aspect of the adductor magnus which allow for knee flexion and hip adduction. Via the tibial nerve, the sciatic nerve innervates the muscles of the posterior leg, including the flexor hallucis longus, flexor digitorum longus, tibialis posterior, popliteus, gastrocnemius, soleus, and plantaris and the sole of the foot, including. The common peroneal nerve innervates the muscles of the anterior and lateral leg, including tibialis anterior, extensor hallucis longus, extensor digitorum longus, fibularis tertius, fibularis longus, and fibularis brevis.

Superior gluteal nerve:

Innervates the gluteus medius, gluteus minimus, and tensor fascia lata. The gluteus medius and minimus function together to abduct the hip, internally rotate the flexed hip, and externally rotate the extended hip. The tensor fascia lata flexes, medially rotates and abducts the hip while also externally rotating the leg at the knee.

Inferior gluteal nerve:

After exiting the pelvis, the inferior gluteal nerve immediately pierces into the only muscle it innervates, the gluteus maximus. The gluteus maximus externally rotates and extend the thigh at the hip joint. It attaches to the iliotibial tract laterally to support the extended knee.

The nerve to internal obturator and superior gemellus muscles:

As the name implies, this nerve innervates the internal obturator and superior gemellus muscles. The internal obturator is responsible for abducting the thigh and externally rotating the extended thigh. It is a major stabilizer of the hip during walking. The superior gemellus helps with externally rotating the thigh.

The nerve to quadratus femoris and inferior gemellus muscles:

The quadratus femoris externally rotates and adducts the thigh. The inferior gemellus is an external rotator of the thigh.

Physiologic Variants

The nerves of the lumbosacral trunk have shown variance in terms of how they arise from the roots, how they exit the pelvis and associate with the piriformis, and their course the body.[1][2][4][5]

Surgical Considerations

The majority of patients who present with lower extremity radiculopathy improve with nonoperative management alone.[6][7] Even in the setting of acute injuries with MRI evidence of a lumbar disc herniation and correlating clinical symptoms in the motor/sensory distribution of the specific nerve root(s) involved, nonoperative management remains the mainstay of initial treatment.[8] Greater than 95% of lumbar disc herniations involves the L4/L5 and/or L5/S1 disc spaces, with patients typically presenting with low back pain with sharp, stabbing pain often traceable from the lower lumbar region to the lower leg and foot.[9][10][8]

The most common indication for surgical intervention is persistent, intractable pain following exhaustion of all possible nonoperative treatment options (physical therapy, rest, NSAIDs) for a minimum of a dedicated 6 week period.[11]

Clinical Significance

Lower extremity radiculopathy, often ambiguously ill-defined even by healthcare providers and physicians as "sciatica," is frequently attributable to nerve root(s) compression and impingement at one or multiple nerve roots in the lumbosacral plexus. These nerve roots ultimately contribute innervation (motor/sensory) peripherally as the sciatic nerve, manifests as shooting, stabbing, and/or burning pain radiating from the back to the ipsilateral or contralateral lower extremity. Accurate clinical diagnosis is critical to ensure utilization of the ideal management modalities for each patient.

Diabetes Mellitus

Clinical differentiation and accurate delineation of underlying sources of pain in adult patients presenting with chronic low back pain and radicular symptoms are further fraught with ambiguity in the setting of diabetes. Diabetic lumbosacral radiculoplexus neuropathy (DLSRPN) is easily confused with lower extremity radiculopathy. Etiologically, long-standing, poorly controlled, diabetes can lead to widespread stenosis affecting the microvasculature, including the vaso nevorum, that supplies peripheral nerves in many regions of the body.

The patient often complains of pain, tingling, numbness, and hypersensitivity. The treatment of diabetic neuropathy is multimodal and may include the use of tricyclic antidepressants. The actual benefit of these agents remains debated in the literature. The primary concern of diabetic neuropathy is the development of ulcers which often go undetected because patients lack the appropriate sensory feedback that is physiologically present in non-diabetics.[12]

Other pertinent clinical conditions

Sacral tumors can also cause lumbosacral plexopathy.[13] Surgery may be necessary within the setting of progressive neurologic deficits or debilitating pain and neurologic symptoms secondary to mass effect.

Trendelenburg gait occurs secondary to weakness and dysfunction of the gluteus medius and minimus. The former normally functions as a critical stabilizing force for the pelvis during the stance phase of the gait cycle. Hip abductor compromise results in a characteristic "lurching" gait pattern as the patient compensates to shift their center of gravity toward the side of the stance limb; Trendelenburg gait pathology can be summarized as follows:

- Right-sided hip abductor dysfunction results in:
    - Compromise to the hip abductor pelvic stabilizing function during gait
    - When the right limb is the stance limb during gait, the left side of the pelvis will "droop"
    - The patient compensates for the left-sided "droop" by leaning toward the side of the lesion (in this case, the right side)

- Leaning toward the right side thereby shifts the center of gravity during ambulation

- A cane improves gait biomechanics and is helpful when used on the contralateral (i.e., unaffected) side

Hip abductor dysfunction leading to Trendelenburg gait can occur in the setting of lesions in the superior gluteal nerve, often by a needle hitting the nerve during a gluteal injection, or via L5 radiculopathy etiologies.[2] Neuropraxia following surgery about the hip can also result in a Trendelenburg gait (e.g., following total hip replacement, hemiarthroplasty, or approaches to the hip/pelvis for open reduction internal fixation of various fracture patterns).[14] [15]

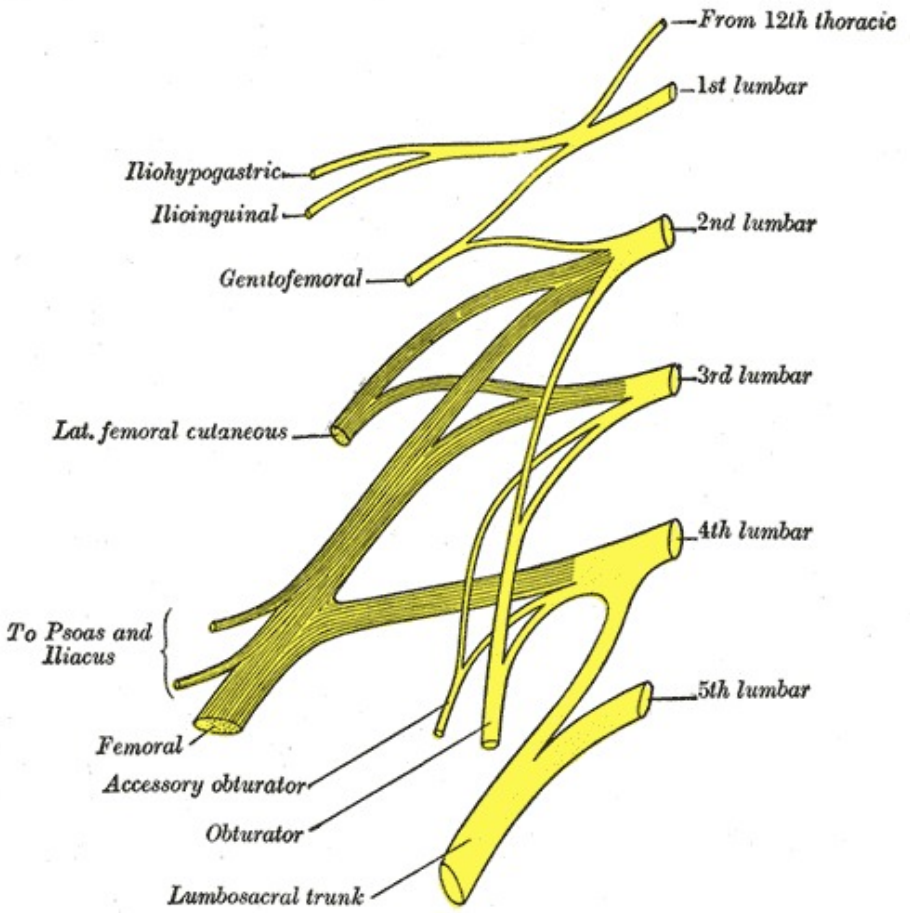
Questions

To access free multiple choice questions on this topic, click here.

References

1. Giuffre BA, Jeanmonod R. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Dec 16, 2018. Anatomy, Sciatic Nerve. [PubMed: 29494038]
2. Lung K, Lui F. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Dec 9, 2018. Anatomy, Abdomen and Pelvis, Superior Gluteal Nerve. [PubMed: 30571029]
3. Merryman J, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Nov 13, 2018. Anatomy, Abdomen and Pelvis, Inferior Gluteal Nerve. [PubMed: 30422479]
4. Desai SS, Cohen-Levy WB. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Feb 1, 2019. Anatomy, Bony Pelvis and Lower Limb, Tibial Nerve. [PubMed: 30725713]
5. Hardin JM, Devendra S. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Dec 6, 2018. Anatomy, Bony Pelvis and Lower Limb, Calf Common Peroneal (Fibular) Nerve. [PubMed: 30422563]
6. Alexander CE, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Nov 15, 2018. Lumbosacral Radiculopathy. [PubMed: 28613587]
7. Donnally III CJ, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Oct 27, 2018. Lumbosacral Disc Injuries. [PubMed: 28846258]
8. Donnally III CJ, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Oct 27, 2018. Lumbar Degenerative Disk Disease. [PubMed: 28846354]
9. Alexander CE, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Nov 15, 2018. Lumbosacral Facet Syndrome. [PubMed: 28722935]
10. Donnally III CJ, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Oct 27, 2018. Lumbar Spondylolysis And Spondylolisthesis. [PubMed: 28846329]
11. Pearson A, Lurie J, Tosteson T, Zhao W, Abdu W, Mirza S, Weinstein J. Who should have surgery for an intervertebral disc herniation? Comparative effectiveness evidence from the spine patient outcomes research trial. Spine. 2012 Jan 15;37(2):140-9. [PMC free article: PMC3472961] [PubMed: 21681140]
12. Bodman MA, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jan 5, 2019. Diabetic Neuropathy. [PubMed: 28723038]
13. Tenny S, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jan 1, 2019. Chordoma. [PubMed: 28613596]
14. Deak N, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Feb 3, 2019. Hip Precautions. [PubMed: 30725716]
15. Gold M, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Nov 14, 2018. Anatomy, Bony Pelvis and Lower Limb, Hip Joint. [PubMed: 29262200]

Figures



The Lumbosacral Plexus, Plan of lumbar plexus. Contributed by Gray's Anatomy Plates

Bookshelf ID: NBK539878 PMID: 30969700