Lumbosacral Plexus: Anatomy and Nerves

In the second part of the article about the spinal cord and peripheral nervous system, the lumbosacral plexus is discussed. Aside from that, medical students receive an insight into some review questions.

Lumbosacral Plexus

The **lumbosacral plexus** is formed by the **anterior rami** of the nerves (spinal segments T12–S4) to supply the **lower limbs**. The lumbosacral plexus can be divided into the **lumbar plexus**, which innervates the ventral upper half, and the **sacral plexus**, which mainly innervates the dorsal side.
Lumbar Plexus
The lumbar plexus is composed of segments Th12-L4 and is located next to the lumbar spine behind the psoas major muscle. In addition to the short nerves leading to the hip muscles, the lumbar plexus includes the following major nerves:

- Iliohypogastric nerve: Th12-L1
- Ilioinguinal nerve: Th12-L1
- Genitofemoral nerve: L1-L2
- Lateral cutaneous nerve of the thigh: L2-L4
- Femoral nerve: L1-L4
- Obturator nerve: L2-L4

**Tip:** To help with memorizing the branches of the lumbar plexus, use the following mnemonic: Indians In Georgia Love Fresh Oranges.
Iliohypogastric nerve

The iliohypogastric nerve proceeds obliquely laterally on the quadratus lumborum muscle and runs ventrally. It supplies motor innervation to the caudal portions of the transverse abdominis and the internal oblique muscles of the abdomen. It is further divided into the anterior cutaneous branch and the lateral cutaneous branch for sensory innervation of the skin above and to the side of the inguinal ligament.

Ilioinguinal nerve

This nerve runs below the iliohypogastric nerve; it leans against the abdominal wall and pierces through it at a spot that varies to finally run medially at the level of the inguinal ligament and to pass through the external inguinal ring to the pubic symphysis and the scrotum or the labia majora.
The ilioinguinal nerve also provides motor innervation to the caudal portions of the transverse abdominis and internal oblique muscles of the abdomen and, as sensory branches, possess the femoral branch supplying the upper and inner parts of the anterior thigh, and the anterior scrotal nerve supplying the anterior part of the scrotum or the labia majora.

Genitofemoral nerve

After it pierces the psoas major muscle, the genitofemoral nerve is divided into the genital branch and the femoral branch.

The purely sensory femoral branch passes through the vascular lacuna in the area of the saphenous opening and supplies the skin below the inguinal ligament, whereas the genital branch, accompanied by the spermatic cord or round ligament of the uterus, moves through the inguinal canal toward the scrotum or the labia majora, which it supplies with sensory innervation, as it does for the region of the medial thigh. It provides motor innervation to the cremaster muscle.

Lateral cutaneous nerve of the thigh

The purely sensory lateral femoral cutaneous nerve supplies the lateral skin of the thigh. It passes the psoas major muscle and then the muscular lacuna to finally break through the fascia lata.

Femoral nerve

The femoral nerve is the longest nerve of the lumbar plexus. It runs between the psoas major muscle and iliacus muscle and reaches the muscular lacuna on the lateral side of the femoral artery and vein.

Note: The mnemonic NAVEL summarizes the position of the structures in the muscular lacuna: Nerve, Artery, Vein, Empty space, Lymphatics.
Just below the inguinal ligament, nerves divide into the sensory **anterior femoral cutaneous nerves** to supply the skin of the anterior thigh and into the **motor branches** that supply the following muscles:

- **Iliopsoas muscle**
- **Pectineus muscle**
- **Sartorius muscle**
- **Quadriceps femoris muscle**

The **saphenous nerve** is the sensory terminal branch of the femoral nerve that
courses along the femoral artery and vein and moves into the **adductor canal**. Finally, it follows the **great saphenous vein** to the medial side of the lower leg. Thus, it innervates the skin between the knee and the foot on the medial side.

**Obturator nerve**

The **obturator nerve** moves behind the **psoas major muscle** distally and leans against the wall of the pelvis; together with the **obturator artery**, it enters through the **obturator canal** to move to the inner thigh.

Before the obturator nerve divides into anterior and posterior branches, which run distally in front of or behind the adductor brevis muscle and innervate the adductor muscles (**adductor longus, adductor brevis, gracilis, pectineus, and adductor magnus muscles**), it releases a branch for the innervation of the **obturator externus muscle**.

The anterior branch ends in the sensory **cutaneous branch**, which innervates a palm-sized area at the distal end of the inner thigh.

---

**Sacral Plexus**

The sacral plexus is composed of the segments L4–S4 and sits on the piriformis muscle. It provides short motor branches to supply the hip muscles and further consists of the following nerves, the most important of which are described below:

- **Superior gluteal nerve**: L4–S1
- **Inferior gluteal nerve**: L5–S2
- **Posterior femoral cutaneous nerve**: S1–S3
- **Sciatic nerve**: L4–S3
  - **Common peroneal (fibular) nerve**: L4–S2
  - **Tibial nerve**: L4–S3
- **Pudendal nerve**: S1–S4

**Superior gluteal nerve**

The purely motor superior gluteal nerve follows the superior gluteal vessels and moves through the suprapiriform foramen to supply the gluteus medius, gluteus minimus, and tensor fascia lata muscles.

Because these three muscles are primarily responsible for abduction of the hip joint and the stabilization of the pelvis in the frontal plane, a lesion of the nerve (e.g., in the case of an incorrectly performed intramuscular injection) causes the so-called **Trendelenburg’s sign**. When walking or standing on one leg, the pelvis tilts toward the healthy side, resulting in a waddling gait called the ‘Trendelenburg gait’ or the ‘gluteal gait.’
Inferior gluteal nerve

The purely motor inferior gluteal nerve moves together with the inferior gluteal vessels, the sciatic nerve, the posterior femoral cutaneous nerve, and the pudendal nerves, as well as the pudendal vessels, through the infrapiriform foramen and innervates the gluteus maximus muscle. Damage to this nerve is more rare than is damage to the superior gluteal nerve, but this damage leads to severe limitations when standing up, climbing stairs, and jumping.

Coccygeal nerve

- Nerves to levator ani and coccygeus (Sr, S4) >> muscles of the pelvic floor
- Anococcygeal nerve >> skin between coccyx and anus

Posterior femoral cutaneous nerve

The purely sensory posterior femoral cutaneous nerve passes through the foramen infrapiriform and innervates the dorsal side of the thigh. To supply the gluteal fold, it releases the inferior cluneal nerves.

Sciatic nerve
The sciatic nerve is the largest nerve of the human body and, along with the saphenous nerve, supplies the skin of the lower leg. After passing through the greater sciatic foramen below the piriformis muscle, it moves along the back of the thigh to the popliteal fossa. Above the popliteal fossa, it usually divides itself into the tibial nerve and the common fibular (or peroneal) nerve.

Even before the division of the sciatic nerve, a fibular part (F) can be distinguished from a tibial part (T). Each of them makes branches for the following muscles:

- Semitendinosus muscle (T)
- Semimembranosus muscle (T)
- Biceps femoris muscle
  - Long head (T)
  - Short head (F)
- Adductor magnus muscle (T) (superficial part)

After its separation from the sciatic nerve at the popliteal level, the common fibular nerve breaks off into two branches for the sensory innervation of the lateral and posterior lower leg: the lateral sural cutaneous nerve and the communicating branches, which in order to ensure sensory supply of the posterior lower leg, merge with a branch of the tibial nerve to form the sural nerve.

The common fibular nerve moves around the head of a fibula to the anterior side of the lower leg, and, after entering the peroneal (fibularis) longus muscle, it divides into its terminal branches: the superficial fibular (peroneal) nerve and the deep fibular (peroneal) nerve. (For motor innervation, see the table below.)
The superficial fibular nerve runs between the two fibular muscles to the dorsum, where it ends in the sensory medial and intermediate cutaneous nerves, which innervate the dorsum and medial border of the foot.

The deep fibular nerve reaches the extensor compartment after breaking through the anterior intermuscular septum of the leg and moves between the tibialis anterior and extensor hallucis longus muscles to the dorsal side of the foot. The sensory terminal branch supplies the skin of the first interdigital space (autonomous zone).

Note: In cases of dysfunction of the fibular nerve, a heel strike is no longer possible. Because of the resulting weakness of the extensor muscles, a characteristic ‘foot drop’ may be observed.

The tibial nerve releases a medial sural cutaneous nerve, which merges with the communicating fibular nerves to form the sural nerve that courses alongside the small saphenous vein and moves caudally to the popliteal space between the heads of the gastrocnemius muscle downward in a vertical fashion.

Furthermore, in its course, the tibial nerve lays between the soleus muscle and the lower leg flexors, which it also innervates. Along the medial malleolus, it reaches the plantar aspect of the foot, where it divides into its terminal branches for motor and sensory innervation of the sole: the medial plantar nerve and the lateral plantar nerve.
**Note:** In cases of dysfunction of the tibial nerve, standing tiptoe is not possible.

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Motor innervation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial fibular (peroneal) nerve</td>
<td>Musculus fibularis longus, musculus fibularis brevis</td>
</tr>
<tr>
<td>Deep fibular (peroneal) nerve</td>
<td>Musculus tibialis anterior, musculus extensor digitorum longus, musculus extensor hallucis longus, musculus extensor digitorum brevis, musculus extensor hallucis brevis</td>
</tr>
<tr>
<td>Tibial nerve</td>
<td>Musculus gastrocnemius, musculus soleus, musculus plantaris, musculus tibialis posterior, musculus flexor digitorum longus, musculus flexor hallucis longus</td>
</tr>
</tbody>
</table>

For an overview of the sensory innervation of the lower limb, see the following figure: