The main reason why neurology is considered intimidating is because it requires precise lesion localization for a successful work-up. A “down” or paralyzed patient can have a lesion in the spinal cord or somewhere along the peripheral nervous system. An MRI examination of the spine would be useless if the lesion is in the peripheral nervous system instead of the spinal cord!

When localizing lesions it is helpful to start with “big regions” first and then progressively narrow it down. This process can start with defining whether the lesion is in the central or peripheral nervous system (CNS or PNS). Then if it is within the CNS, localize it to the brain or spinal cord. Considering the high prevalence of spinal cord disorders, the text will discuss primarily lesion localization within the spinal cord.

It is important to localize the spinal lesion as closely as possible to concentrate diagnostic efforts on the affected region. The principles of upper motor neuron (UMN) and lower motor neuron (LMN) are used to localize lesions within the spinal cord. *Upper motor neuron* is a term used to designate a group of motor tracts originating from the brain and terminating within the spinal cord. The most important tracts forming the UMN are the corticospinal, rubrospinal, reticulospinal, and vestibulospinal tracts. Basically, the combined function of the UMN is to facilitate gait in animals, inhibiting extensor muscles of the limbs while facilitating flexor muscles. As such, when the animal has an UMN spinal cord lesion, there is paresis or paralysis with increased extensor tone of the limbs (due to the lack of UMN inhibition). The hallmark of UMN signs are then paralysis or paresis with increased extensor tone (spasticity or hypertonus), normal to increased spinal reflexes (hyperreflexia), and slowly progressive muscle atrophy from disuse. On the other hand, LMN is formed by a group of neurons that originate in the ventral grey horn of the spinal cord or in a nuclei of the brainstem, to give origin to peripheral or cranial nerves that then innervate the target muscle(s).

Lower motor neuron is also known as the final common pathway because any motor activity to be displayed has to go through the LMN. When the patient has a lesion somewhere along the LMN pathway, such as in the spinal cord enlargement (ventral grey horn), nerve roots, spinal nerve, peripheral nerve, or neuromuscular junction, LMN dysfunction occurs. Clinical signs of LMN dysfunction are basically the opposite as those seen with UMN lesions: paresis or paralysis with absent to decreased extensor tone.
(flaccidity or hypotonus), decreased or absent spinal reflexes (hyporeflexia or areflexia, respectively), and rapid and severe (neurogenic) muscle atrophy. The presence of UMN or LMN signs dictates the location of the lesion within the spinal cord.

Clinically, the spinal cord can be divided into four regions, cervical (C1-5), cervicothoracic (C6-T2), thoracolumbar (T3-L3), and lumbosacral (L4-S3). Involvement of all four limbs suggests a lesion at either C1-C5 or C6-T2. Assuming increased tone and reflexes in the pelvic limbs, normal to increased tone and reflexes (UMN signs) in the thoracic limbs indicate a lesion at C1-5, while decreased to absent tone and reflexes (LMN signs) suggest a lesion at C6-T2.

Paraplegia or paraparesis indicates a lesion caudal to T2. Normal to increased reflexes and muscle tone points to a T3-L3 lesion, the most common site for spinal lesions. More specific lesion localization within the segment T3-L3 can be achieved using the cutaneous trunci reflex and spinal palpation. Decreased tone and reflexes suggest a L4-S3 lesion. It is important to note that the lumbosacral spinal cord segments do not match with their corresponding vertebrae. The entire lumbar enlargement (L4-S3) is located within the vertebrae L4-L5 in most dogs, and L5-L6 in cats. Lesions involving the vertebrae L6, L7, and S1 in dogs affect the nerve roots for the pelvic limbs, perineal region, sphincters and tail (reflecting involvement of sciatic, pudendal, pelvic and caudal nerves). As there is no spinal cord in this region, no proprioceptive ataxia is observed (although proprioceptive positioning deficits may be seen), but paraparesis and pain in the lumbosacral area are present. The flexor and perineal reflexes display signs of LMN.