# Motor Neuron Signs UMN and LMN

When damage occurs to the central or peripheral nervous system, a patient will manifest with characteristics that are unique to the site of the lesion. These characteristics can be broadly classified as either upper motor neuron (UMN) signs, referring to first-order neurons in the cerebral cortex and spinal cord, or lower motor neuron (LMN) signs, referring to all other neurons that continue to transmit motor impulses throughout the peripheral nervous system. In general, damage to an UMN will show increased deep tendon reflexes (DTRs), increased muscle tone, positive Babinski sign, and spastic paralysis with a clasp-knife reaction. Damage to a LMN will show decreased DTRs, decreased muscle tone, negative Babinski sign, flaccid paralysis, muscle atrophy, and fasciculations.

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## Upper Motor Neuron (Increases)

### Increased DTRs

Up-arrow DTR-reflex-hammer

Deep tendon reflexes (DTRs) are tested by tapping on a muscle tendon in order to assess the reflex on a scale of 0 to 5+, with 0 being an absent reflex, 1-3+ being normal, 4+ being nonsustained clonus, and 5+ being sustained clonus. Clonus is repetitive vibration and contraction of a muscle and is an abnormal clinical finding.

### Positive Babinski

Positive-sign Baby-ski

The plantar (Babinski) reflex can be elicited by using a firm object to scrape the sole of the foot starting from their heel and moving upwards to the base of their toes. A Babinski sign is present if the big toe extends upwards and the other toes fan outward. This is a normal reflexive response in infants up to age 2, due to incomplete myelination of their corticospinal tract fibers. At about 2 years of age, corticospinal fibers have fully myelinated and the Babinski sign becomes suppressed. A Babinski sign after this age is pathologic (abnormal) and indicates an UMN lesion.

### Spastic Paralysis

Space-tick in Wheelchair

Spasticity is associated with the increased muscle tone of UMN lesions; when a muscle is spastic, it is very stiff and resistant to voluntary movement, and thus the phenomenon is referred to as spastic paralysis. If the UMN injury occurs before the pyramidal decussation of the corticospinal tract, then spasticity occurs contralateral to the lesion. However, if the UMN injury occurs after the pyramidal decussation of the corticospinal tract, then spasticity occurs ipsilateral to the lesion.

### Clasp-Knife Reaction

Clasping-Knife

Imagine closing a pocket knife; once a certain amount of force is applied to the otherwise rigid blade, it will give way and close rapidly. In the same way, the spastic, hypertonic muscles of a patient will be very resistant to the force applied by an examiner until finally they will suddenly relax and be mobile.

## Lower Motor Neuron (Decreases)

### Decreased DTRs

Down-arrow DTR-reflex-hammer

Since the LMN directly innervates the muscle, it makes sense that if the neuron is injured, then muscle reflexes and tone will decrease as they have deficient neural input. The DTRs are decreased accordingly, usually assessed as either 0 (absent) or 1+ (trace) on the scale described in point one.

### Negative Babinski

Negative-sign Baby-ski

A negative Babinski sign is seen when the toes flex downward (or not flex at all) upon scraping the sole of the foot with a firm object. After about 2 years of age the corticospinal tracts are usually completely myelinated, so it is normal for individuals not to have extension of the toes upon plantar scraping. Absence of the plantar (Babinski) reflex can also be found in individuals with LMN lesions.

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**Flaccid Paralysis**

Limp Wheelchair

Flaccid paralysis occurs when the patient lacks the ability to move the affected muscle due to damaged LMN fibers. The flaccid muscles cannot be voluntarily moved, and flaccid paralysis occurs.

**Muscle Atrophy**

Muscle-man @-trophy

Usually not observed until after some time has passed following initial neuronal injury, muscle atrophy occurs due to the lack of nervous system stimulation and movement that would normally follow in a healthy patient. Identifying which muscles are atrophied can help identify the innervating nerves and therefore help identify the site of the LMN lesion.

**Fasciculations**

Fast-pickle

When a LMN spontaneously depolarizes, which happens in healthy patients but more so when nerves are damaged, muscle twitches known as fasciculations can be observed. These twitches are involuntarily and are frequently a sign of LMN damage.

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