

# Neurological: Part 1

## Overview of the Neurological Evaluation

by Dr. Kevin McNamee, DC. L.Ac.

### Overview

The acronym HIPPIRONEL is used to help the practitioner remember the steps of the patient encounter as well as to stay organized. This also keeps the practitioner's thoughts free to focus on the cause of the patient's chief complaints.

When approaching a patient, the sequence of events with the encounter is as follows: 1) the patient's chief complaint leads to the history needed, 2) the history leads to the type of 3) examination. The history and examination may indicate if any 4) diagnostic imaging and/or laboratory tests need to be ordered.

As with most parts of the examination, the practitioner needs to keep in mind the possibility need to contact a specialist for a consultation if there is an abnormal finding that is unusual or unfamiliar to the practitioner. A list of quality consultants such as a neurologists, internists, orthopedists, etc. is essential to any practice if the need arises for a specialist condition.

### The Examination

After completing the history, the type of examination needed is determined based on the information obtained. For example, if the patient's history indicates there is a problem with the left buttock and there is no indication to examine the neck and upper extremities, the practitioner should focus on the low back and lower extremity examination.

The acronym mentioned above is **HIPPIRONEL**. The **H** stands for the history. We are assuming the history has already been performed and that the examination is next. The acronym for the rest of the patient encounter is **IPPIRONEL** which stands for:

### IPPIRONEL

- I Inspection
- P Palpation - Superficial and Deep
- P Percussion
- I Instrumentation
- R Range of Motion - Active, Passive and Resisted
- O Orthopedic
- N Neurological - Mental Status, Coordination, Cranial Nerve, Motor, and Sensory Testing
- E X-ray and Diagnostic Imaging - X-ray, CT, MRI, Bone Scan, Ultrasound, Thermography, EMG, NCV, EEG, etc.
- L Laboratory - CBC, Chem Panel, etc.

In this section, a discussion of the neurological tests to be conducted by the practitioner is presented. The purpose of neurological tests involving a musculo-skeletal complaint is to find any nervous system lesions – an interference of any type to the normal function of the nervous system.

**Neurological testing to consider and/or perform includes:**

1. mental status,
2. cerebellar testing for coordination,
3. deep tendon reflexes,
4. superficial reflexes,
5. pathologic reflexes,
6. cranial nerve testing,
7. measuring body parts (girth),
8. grading muscular strength and
9. gross sensory perception.

During the patient encounter, the **screening examination for neurological conditions**, when no known neurologic problem is apparent, include:

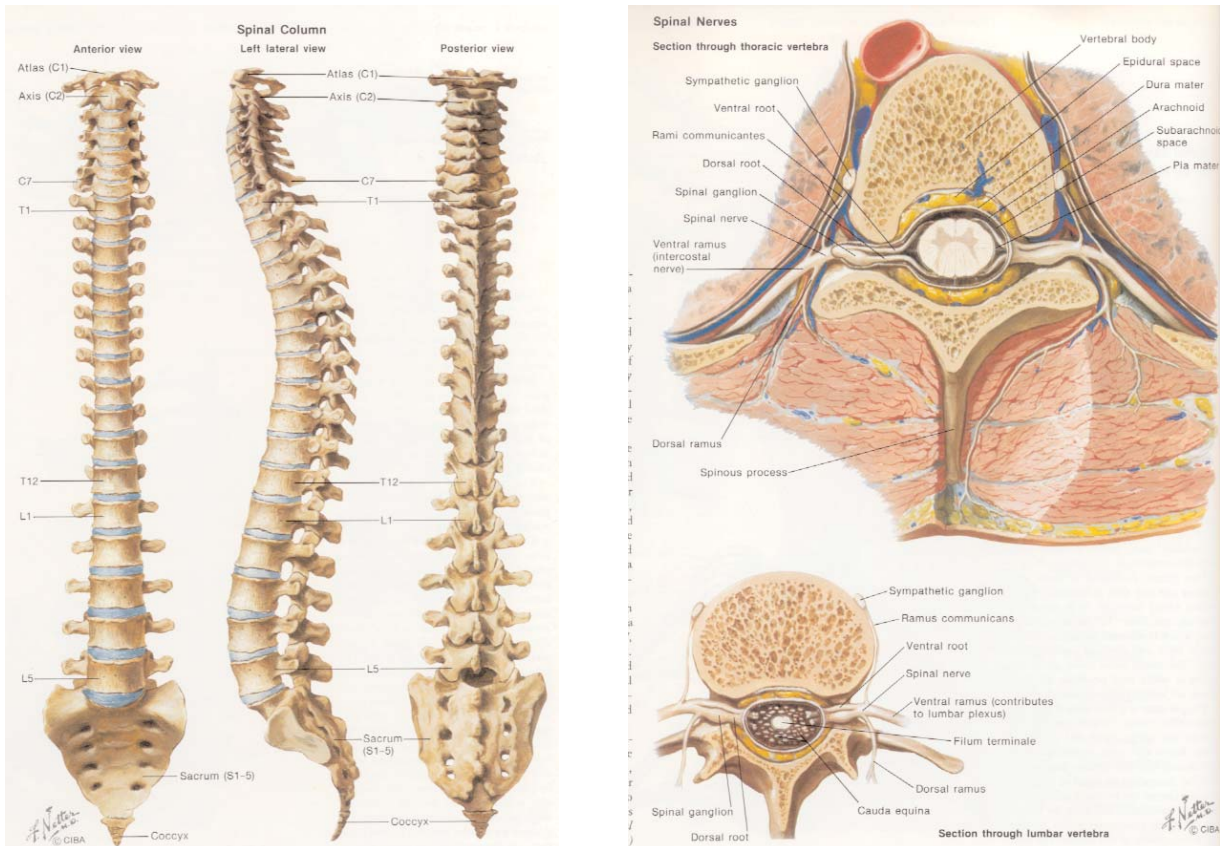
1. Cranial Nerves (II through XII);
2. Proprioception and Cerebellar Function (One test for rapid rhythmic alternating movements, accuracy of movements, balance (Rhomberg test), gait and/or heel-toe walking);
3. Sensory Function, superficial sharp/dull, temperature and touch (gross and light) at a distal point in each extremity, vibration and position senses assessed by testing the great toe; and
4. Deep Tendon Reflexes (all deep tendon reflexes are tested, excluding the test of clonus).

**General Anatomy**

The nerve roots exit the spinal cord at each segmental level and are numbered in relation to the level from which they exit. **Eight** cervical, **twelve** thoracic, **five** lumbar and **five** sacral nerves make up the spinal nerves. The **C5 to T1** segments enervate the **upper** extremity and the **T12 - S4** segments enervate the **lower** extremity.

When pathology exists in the spinal cord and/or nerve roots, corresponding symptoms and signs will be present in the corresponding extremities according to the specific neurologic levels involved. Each level has its own specific neurological characteristics and can provide an indication of which spinal cord and nerve root level is involved.

## General Anatomy of the Spine and Nerves



Differentiation of which spinal cords and nerve root levels are involved depends on the **dermatomes (sensation), myotomes (muscle) and reflexes** findings. **Dermatomes** are the areas of sensation on the skin supplied by a **single** spinal segment. The **myotomes** are the **groups of muscles** enervated by a single spinal segment. The dermatomes, myotomes and reflexes provide information as to the level of lesion involvement.

### Equipment for a Neurological Evaluation

When performing that portion of the examination concerning the nervous system, the equipment needed include:

- Penlight
- Tongue blade
- Sterile needles
- Tuning forks, 128 Hz and 512 Hz
- Familiar objects – coins, keys, paper clip
- Cotton wisp
- Reflex Hammer
- Vials of aromatic substances – coffee, orange, peppermint extract, oil of cloves
- Vials of solutions – glucose, salt, lemon or vinegar, or quinine – with applicators
- Test tubes of hot and cold water for temperature sensation testing
- Tape measure
- J-mar Grip Strength Hand Dynamometer

## Motor, Sensory and Reflexes

Nerves have two functions, **motor and sensory**. Signals are sent back and forth between the brain, spinal cord and nerves to the body's muscles and organs. The impulses which supply the muscles with information are carried by the spinal cord.

Motor information travels in the spinal cord primarily by the corticospinal tract. If there is an interruption of this impulse or signal to the muscle, such as spinal cord injury, the myotome results in spastic paralysis, whereas pressure on the nerve root may cause a decrease in muscle strength.

Perception of superficial pain and temperature is through the spinal cord's lateral spinothalamic tract. Superficial touch and deep pressure is carried in the ventral (anterior) spinothalamic tract. Vibration, deep pressure, position sense, stereognosis, point location and two-point discrimination are carried through the posterior column. Proprioception is carried through the anterior and dorsal spinocerebellar tracks. (See Table 1: Neurological Spinal Tracts)

**Table 1: Neurological Spinal Tracts**

<b>Neurological Signal</b>	<b>Neurological Tract through the Spinal Cord</b>
Superficial Pain	Lateral Spinothalamic Tract
Superficial Touch and Deep Pressure	Ventral (anterior) Spinothalamic Tract
Vibration, Deep Pressure Sense, Steriognosis, Point Location, and Two-point Discrimination	Posterior Column
Proprioception	Anterior and Dorsal Spinocerebellar Tracts
Motor	Corticospinal track

Pathology to the cord or nerve root results in the loss of light touch, followed by loss of sensation of pain. When a nerve is regenerating from nerve root injury, sensation of pain returns before light touch. Light touch is tested using a cotton swab or similar object. Pain is tested with pinpricks, either a pinwheel or a safety pin.

Sensation testing is recorded in the patient notes using the descriptions normal, hyperesthetic (increased), hypoesthetic (decreased), dysesthetic (altered) or anesthetic (absent). The following is a list of neurological levels for the upper and lower extremities.

## **Neurologic Levels in Upper and Lower Extremity**

### **Motor**

#### **Upper Extremity**

- C5 Shoulder abduction
- C6 Wrist extension
- C7 Wrist flexion and finger extension
- C8 Finger flexion
- T1 Finger abduction, adduction

#### **Lower Extremity**

- L4 Anterior Tibialis
- L5 Extensor Digitorum Longus
- S1 Peroneus Longus

### **Sensation**

#### **Upper Extremity**

- C5 Lateral arm
- C6 Lateral forearm, thumb, and index finger
- C7 Middle finger (variable)
- C8 Medial forearm, ring, and small finger
- T1 Medial arm
- T2 Axilla

#### **Lower Extremity**

- L4 Medial Ankle and Foot
- L5 Top of Foot
- S1 Lateral Ankle and Foot

## Reflex

### Upper Extremity

C5	Biceps
C6	Brachioradialis
C7	Triceps

### Lower Extremity

L4	Patellar Tendon
S1	Achilles Tendon