

BACKGROUND

Some diseases of the nervous system are characterized by decreased velocity of impulse conduction along the nerve fibers. One way in which this conduction velocity can be measured is to stimulate a peripheral nerve fiber, and then to measure the time to the production of a characteristic somatosensory evoked potential (SEP) in the spinal cord or brain as measured by electrodes placed over the spine or head. There are no references currently, however, which identify the normal range of conduction velocities for humans.

The data arise from 250 patients between the ages of 20 and 90 who were undergoing some surgical procedure related to their spine between January 1, 1990 and November 10, 1991. The neurological exams for these patients were essentially normal. Each patient had the posterior tibial nerve of each leg electrically stimulated at a standard location near the medial malleolus (ankle), and the cortical somatosensory evoked potential (SEP) was measured from electrodes placed at standard locations on the head. The electrodes measure electrical activity in specific regions of the brain, and the SEP appears as a pattern of waves in the recording. Two different models of equipment (referred to as the GE 1762 and the GE 1772) were used to perform the study, and the choice of equipment for a particular patient was determined by its availability at the time. The clinical researchers believe that the two models produce identical results.

In previous research, a common pattern of wave peaks had been noted: First a poorly defined negative SEP is observed, followed by a relatively sharp positive peak, a relatively sharp negative peak, and then a more rounded positive peak. We have labeled these peaks according to their approximate delay (in milliseconds) after the stimulus: n35, p40, n50, and p60, respectively. Some previous researchers have considered the time to observing each of these peaks, while others have considered the times between specific peaks.

For each patient, you have measurements of the measurement conditions (DATE and EQUIPMENT), patient characteristics (AGE, HEIGHT, SEX) and measurements of time delay, in milliseconds, to observing each peak after stimulating either the left (L) or right (R) posterior tibial nerve. These delay times are labeled n35L, n35R, p40L, p40R, n50L, n50R, p60L, and p60R.

QUESTIONS OF INTEREST

The primary goal of this analysis is to obtain reference ranges to which measurements on future patients might be compared. To that end, we desire answers to the following questions:

1. What patient characteristics should be considered when establishing a reference range?
2. What are the reference ranges you derived from this analysis? In keeping with typical medical practice, a reference range that includes 95% of normals is desired.

DESCRIPTION OF THE DATA

The file SEP.txt is a text file in freefield format. Each row in the file corresponds to one of the 250 participants in the study. Missing data is denoted by NA. The first row of the file contains the variable names. The columns correspond to the following variables:

date: date of examination in MMDDYY format (range 010190 to 110891)

equip: equipment used for examination (either 1762 or 1772; the sample includes 127 measurements on the GE 1762))

height: height in inches of the participant (range 53 to 77 inches)

age: age in years of the participant (range 20 to 84 years old)

sex: sex of the participant (0= female, 1= male; the sample includes 113 males)

n35R: time (in milliseconds) to detection of the first negative SEP following stimulation of the right posterior tibial nerve (range 23.4 to 46.8 msec)

- p40R: time (in milliseconds) to detection of the first positive SEP following stimulation of the right posterior tibial nerve (range 33.0 to 53.1 msec)
- n50R: time (in milliseconds) to detection of the second negative SEP following stimulation of the right posterior tibial nerve (range 38.4 to 62.0 msec)
- p60R: time (in milliseconds) to detection of the second positive SEP following stimulation of the right posterior tibial nerve (range 46.2 to 76.6 msec)
- n35L: time (in milliseconds) to detection of the first negative SEP following stimulation of the left posterior tibial nerve (range 23.4 to 46.8 msec)
- p40L: time (in milliseconds) to detection of the first positive SEP following stimulation of the left posterior tibial nerve (range 33.0 to 53.1 msec)
- n50L: time (in milliseconds) to detection of the second negative SEP following stimulation of the left posterior tibial nerve (range 38.4 to 62.0 msec)
- p60L: time (in milliseconds) to detection of the second positive SEP following stimulation of the left posterior tibial nerve (range 46.2 to 76.6 msec)

The file SEPlong.txt is a text file in freefield format. Each row in the file corresponds to one of eight measurements (n35, p40, n50, and p60 on each leg) made on each of the 250 participants in the study. Missing data is denoted by NA. The first row of the file contains the variable names. For convenience, the first 250 rows of the file also contain the data in the “wide” format as described above. The columns correspond to the following variables:

- ptid: patient identification number (a number between 1 and 250)
- date: date of examination in MMDDYY format (range 010190 to 110891)
- equip: equipment used for examination (either 1762 or 1772; the sample includes 127 measurements on the GE 1762))
- height: height in inches of the participant (range 53 to 77 inches)
- age: age in years of the participant (range 20 to 84 years old)
- sex: sex of the participant (0= female, 1= male; the sample includes 113 males)
- n35R: time (in milliseconds) to detection of the first negative SEP following stimulation of the right posterior tibial nerve (range 23.4 to 46.8 msec) *(This variable has missing values (NA) for all but the first 250 rows of the data file.)*
- p40R: time (in milliseconds) to detection of the first positive SEP following stimulation of the right posterior tibial nerve (range 33.0 to 53.1 msec) *(This variable has missing values (NA) for all but the first 250 rows of the data file.)*
- n50R: time (in milliseconds) to detection of the second negative SEP following stimulation of the right posterior tibial nerve (range 38.4 to 62.0 msec) *(This variable has missing values (NA) for all but the first 250 rows of the data file.)*
- p60R: time (in milliseconds) to detection of the second positive SEP following stimulation of the right posterior tibial nerve (range 46.2 to 76.6 msec) *(This variable has missing values (NA) for all but the first 250 rows of the data file.)*

- n35L: time (in milliseconds) to detection of the first negative SEP following stimulation of the left posterior tibial nerve (range 23.4 to 46.8 msec) *(This variable has missing values (NA) for all but the first 250 rows of the data file.)*
- p40L: time (in milliseconds) to detection of the first positive SEP following stimulation of the left posterior tibial nerve (range 33.0 to 53.1 msec) *(This variable has missing values (NA) for all but the first 250 rows of the data file.)*
- n50L: time (in milliseconds) to detection of the second negative SEP following stimulation of the left posterior tibial nerve (range 38.4 to 62.0 msec) *(This variable has missing values (NA) for all but the first 250 rows of the data file.)*
- p60L: time (in milliseconds) to detection of the second positive SEP following stimulation of the left posterior tibial nerve (range 46.2 to 76.6 msec) *(This variable has missing values (NA) for all but the first 250 rows of the data file.)*
- side: “right” or “left” indicating the patient’s side corresponding to the value of *SEP*
- peak: “n35”, “p540”, “n50”, or “p60” indicating the peak corresponding to the value of *SEP*
- SEP: the value of the somatosensory evoked potential peak corresponding to the values of *side* and *peak*.