Morphometry Database for Neve Tissues

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The IT'IS nerve morphometry database provides a generalized view into the various human morphometric characteristics of peripheral nerves. The aim is to provide descriptive values of the nerve tissues included in the ViP 4.0 models (as of January 2020 Yoonsun and Jeduk). The first version of this database includes average values and statistical information (standard deviation, sample size, maxima, and minima) for the diameter, cross sectional area, number of fascicles, and number of myelinated/unmyelinated fibers. Larger variations in the reported data can be due to a number of factors, like the measurement method, the state of the subject or the method of preservation/fixation of tissues. A large contributor to the variability is due to the current approach of calculating the average and standard deviation from all values along the nerve: note for some nerves there may substantial differences between superior and inferior regions.

The database consists of data collected from available literature, the list of references is provided with the download. All morphometric data is based on measurements collected from human subjects.

Diameter

Whenever possible values for both main axis (left and right) of the nerve cross section are provided, adding information on the overall shape of the tissue. Additionally, the number of diameter values is further increased by calculating the diameter from the area, assuming a circular shape of the nerve. The calculated diameter values are presented as 'Areal Diameter'.

Values from the directly measured diameter and the 'Areal Diameter' are pooled together and reported as 'Combined Diameter', which represents a full set of dimeter values with the largest amount of data. When data is available for both axis of the nerve, a single diameter is generated by first calculating the elliptic area and then re-calculating the diameter, but setting equal diameters in the formula, i.e. a circle.

Area

The cross sectional area from nerve tissues is reported from direct measurements. Strictly, when no value was obtained from the literature search, the area is calculated using diameter values. Depending on the available data the circular, or elliptic area is calculated. In these cases the area is calculated from all available area entries and averaged.

Fascicles

Data is collected from publications reporting the amount of fascicles and counted from literature that provides images of histological slices. The fascicular organization can change rapidly in number, size and position within the nerve and differs along the progression of the nerve and sites of nerve branching. The reported average is a global value from all pooled data. Depending on the available data the value reported for the number of fascicles can be dominated by one section only.

Fascicle area and diameter

The values for the fascicles are collected from several publications, not all reporting both parameters. In such cases the circular area is calculated from values collected on the diameter and vice versa. The calculated values are not reported as a separate category, like it is with the nerve diameter and area.

Myelinated and Unmyelinated nerve fibers

The number of fibers of both categories is reported for a limited number of nerves. The parameter refers to the total number of nerve fibers within the whole cross section of the nerve. Additional values will be included in future versions of the morphometric tissue database.

Known Issues

The following list covers some of the current problems of the morphometric tissue database. When possible, we will address these issues in future versions of the database.

1. Over its course, peripheral nerves change in shape and diameter. Collected values could be grouped into equal sections along the nerve as it progresses towards its periphery. The current version of the database does not account for these regional changes.
2. As with the diameter of the nerve, the internal structure of peripherals is constantly changing. Changes in fascicle number, topology, diameter/area and composition changes very rapidly. Currently there is not enough data to address this behavior.
3. Tissues are named according to the segmentation of the V4.0 models Yoon-sun and Jeduk. In some cases the segmentation differs to the anatomy of the peripheral nervous system. Mostly this is due to grouping nerve branches to the parent nerve, to avoid overpopulating the model with short nerve segments. This will lead to the smaller branches receiving the same properties from the database as the parent nerve. Whenever possible values from these branching nerves are included in the average and statistical information of the parent nerve. As an example, the segmentation of the trigeminal nerve (cranial V) includes also distal branches of the nerve. Therefore, the morphometric properties of the inferior alveolar, mandibular, maxillary and ophthalmic nerves are used alongside the values of the trigeminal nerve.
4. The brachial plexus is segmented as a single tissue in the V4.0 models. A large portion of the segmented network merges the lateral, posterior and medial cord, as well as the superior, inferior and middle trunk into a continuous, overlapping structure. Therefore, the averaged values of the brachial plexus will be too low in areas where the plexus is merged. Contrary, if the values of the nerves in question were to be summed it would create the adverse effect of assigning values that are overestimating the characteristics in regions where the network is segmented into individual strands. The database lists an averaged value from different areas in the brachial plexus and additionally provides a separate set of values for the different trunks (upper, middle, lower) of the brachial plexus.