Quantification and Image Analysis Task Group

QIBA Quantitative SPECT Committee

Image Analysis

- Image Analysis
  - image analyst and computer workstation
  - specific binding ratio of striatum (total, caudate, putamen)
- Input Data
  - reconstructed I-123 Ioflupane data
  - spatially normalized
  - summed (averaged) striatal image
- Methods to be Used
  - ROI data analysis
  - $$\frac{striatum_{ROI}}{backgrnd_{ROI}} - 1$$

Image Analysis

The Image Analyst using computer workstation analysis tools shall perform the specified measurements. The main quantitative data analysis task is to determine the Specific Binding Ratios (SBR) of Ioflupane DaTscan for the right and left caudate and putamen. The derived results are then compared to an age normalized database to provide a reference for the SBR versus age matched normals. The profile describes the data analysis methodology.

Quantitative Specific Binding Ratio (SBR) of Ioflupane DaTscan will be based upon patient SBR and compared to an age normalized database. Qualified systems will be able to achieve a SBR within a certain range (i.e., ±5% of reference value) for quantitative imaging of I-123 Ioflupane for the DaTscan phantom (described in this profile). The profile does not seek to make disease determination but to provide the methodology for data analysis and also for qualification of systems and processing for I-123 Ioflupane DaTscan data analysis.

Input Data

The output images from Image Reconstruction are considered the input for Image Analysis. Once stored on the analysis workstation the image data will be processed for region of interest image analysis as described below. The original input data will be maintained as a separate file and will be stored along with the processed data for image analysis.

Methods to be Used

Uptake in the striatum (i.e., caudate and putamen) and background region (e.g., cerebellum or occipital region) is characterized by defining a region-of-interest (ROI). The measurand is the specific binding ratio and is determined from the following equation:

$$\frac{striatum_{ROI}}{backgrnd_{ROI}} - 1 \qquad \text{(eq 1)}$$

where the $backgrnd_{ROI}$ counts are normalized to the same ROI volume as the striatal ROI (i.e., caudate or putamen).

Methods to be Used (ROI definition)

Regions of interests will be drawn on preprocessed images as described below.

On spatial normalized SPECT image volumes the transaxial slice with the highest striatal uptake is identified and the 8 hottest striatal slices around it are averaged to generate a single slice image.

Regions of interest (ROI) are then placed on the left and right caudate, the left and right putamen, and the occipital cortex (reference tissue). It should be clear which values belong to which striatal structures. This can be done by capturing DICOM coordinates along with ROI values or secondary screen capture of the ROI for identification.

Count densities for each region are extracted and used to calculate specific binding ratios (SBRs) for each of the striatal regions. SBR is calculated as (target region/ reference region)-1.

The analyst software should generate a report.

Other Sections

- 3.5 Image Interpretation and Reporting
- 3.6 Quality Control
  - 3.6.1 Imaging Facility
    - 3.6.1.1 Site Accreditation/Qualification Maintenance
  - 3.6.2 Imaging Facility Personnel
  - 3.6.3 SPECT or SPECT/CT Acquisition Scanner
    - 3.6.3.1 Ancillary Equipment
      - 3.6.3.1.1 Radionuclide Calibrator
      - 3.6.3.1.2 Scales and stadiometers
      - 3.6.3.1.3 Clocks and timing devices
  - 3.6.4 Phantom Imaging
    - 3.6.4.1 Uniformity and Calibration
    - 3.6.4.2 Resolution
    - 3.6.4.3 Noise
    - 3.6.4.4 Phantom Imaging Data Analysis

Phantom Imaging Data Analysis

Parameter	Entity/Actor	Specification
Frequency of testing	Imaging site	Shall perform testing, using the striatal DRO (Appendix), of image analysis software when installed and after hardware or software updates
Accuarcy of striatal ROI estimates	Imaging site analysis software	Shall reproduce exact known values for the I-123 SPECT DRO (Appendix). There are ? test objects. The reported values include ... The normalizations include ... The results of the DRO testing shall be recorded in accorance with directions as included in Appendix

Other Sections

- 4.4 Image Analysis Workstation
  - 4.4.1 Image post-processing
  - 4.4.2 Region of Interest (ROI) definition
  - 4.4.3 Calculation of Specific Binding Ratio (SBR)
  - 4.4.4 Image Analysis Workstation Performance Specifications
- 4.5 Software Version Tracking