THE ROUTINE USE OF SURFACE PERFUSION MAPPING FOR SEMIQUANTITATIVE AND QUANTITATIVE BRAIN SPECT EVALUATION. D.G. Pavel, C.J. Thompson, J. Syhra, A. Manasrah, and P. Brander. University of Illinois Hospital, Chicago, IL and SOPHA Medical Systems, Columbia, MD, USA

Routine interpretation of a brain SPECT can be difficult because: a) need of mental integration in order to describe a lesion according to gray matter, white matter, area or volume; b) lack of standardization of displays, and/or of color scales; c) lack of distinguishable, meaningful color shades; d) lack of agreement concerning the normalization of quantitative data. Consequently evaluating subtle abnormalities and identifying, as well as convert- ing, meaningful pictorial information to referring MD can be difficult.

In order to solve such difficulties the 3 standard SPECT views were supplemented, on a combined color printout, with a Surface Relative Perfusion Value Map shown as nine 2-D projections of the 3-D surface generated from a spherically emanating search originating at an internal point. An edge detection on each profile determines radii which after smoothing are converted into cartesian x, y, z vertices characterized by location, radius and perfusion value. The surface normal for each vertex is calculated and activity profiles are resampled along it. The maximum activity (perfusion value) encountered along a specified distance is then associated with its respective vertex. The mapping of the normalized perfusion value onto the projected object surface represents a completely opaque display. A color code with 17 clearly distinguishable, meaningful shades is used, above the threshold, and allows an easy visual semiquantitative evaluation of symmetrical, or asymmetrical areas with an accuracy of ±3%. ROIs of any shape can be drawn and thus tailoring ROIs to the actual lesion is made possible, by following the contours of any presumed abnormal area on any one of the 9 surface views, and mirroring it on the opposite side.

For the physician this routine display represents a surface integration of the information contained in the cortical area of all available 3-D slices. The routine interpretation is significantly helped by the advantages offered on this combined display and by the quantification it enables.

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QUANTIFICATION OF PERCENT CHANGE IN BRAIN PERFUSION DERIVED FROM REGISTERED SPECT SCANS OF EPILEPSY PATIENTS. L. A. Zedan, S.S. Spencer, K. Imam, J. Seibyl, E.O. Smith, G. Wisniewski, P.B. Hoffer, Yale University, New Haven, CT.

A sequence of 3-D image registration, re-normalization, and difference calculations were applied to HMPAO human brain scans of epilepsy patients. Each ictal scan was registered to the same patient's interictal scan. A normalization of the 3D data was applied to account for global percent brain uptake. Functional difference images were computed which demonstrate areas of altered perfusion during ictus. Areas of elevated perfusion differences were identified as suspected areas of seizure foci. Percent-change images were calculated, (which give a quantitative measure of perfusion alterations during ictus) by computing the normalized change within SPECT transverse slices on a pixel by pixel basis. The resulting difference images were also registered with each patient's MRI scan which permits a localization of perfusion changes onto anatomical structures. Areas in the brain where strong perfusion differences occur, correlate with areas suspected to be seizure foci. A subgroup of patients monitored with implanted depth electrodes support this correlation. When compared to side by side visual interpretation of the ictal and interictal SPECT and MRI images together with calculated difference maps greatly enhances the ability to localize seizure foci. From the group of 20 epilepsy patients studied, single focal hyperperfusion during ictus consists with EEG with extratemporal lobe foci. This offers the potential to locate epileptic seizure foci using a non-invasive and inexpensive imaging procedure and data processing algorithm.