ABSTRACT

Cerebral atrophy is a non-specific finding which can result from brain injury or degeneration and which occurs normally in ageing. Many diseases processes result in distinctive patterns of atrophy due to differential involvement of different areas of the brain. In some diseases the pattern of atrophy demonstrated on neuro imaging can be so distinctive that it forms a major component of the diagnosis. In other disorders, such as Alzheimer's disease (AD), the pattern of the atrophic process is close to that of normal ageing. In clinical practice cerebral atrophy is most commonly assessed subjectively by the radiologist, who attempts to identify any specific areas of focal atrophy. In fact, it is clear that subjective assessments of this type are unreliable and poorly reproducible. Many approaches have been taken to improve the assessment of cerebral atrophy, particularly in elderly subjects where normal age-related atrophy makes the interpretation of imaging findings particularly difficult. Despite this, existing techniques tend to be overly simplistic, with poor reliability and reproducibility or computationally expensive and time consuming. There are various ways to estimate brain atrophy based on medical imaging (using MRI and CT). As mentioned above visual inspection for the presence of atrophy may be adequate in a routine clinical setting, but is not sufficient when quantitative measures are needed, for example, to estimate rate of tissue loss during a clinical trial. To assess such changes in a single brain structure, the region-of-interest (ROI) analysis technique may be employed in which an experienced operator outlines the structure in question in a series of contiguous sections on a computer screen. ROI analysis constitutes, up to now, the gold standard in brain atrophy measurements but there are major shortcomings such as observer/ operator dependency and bias in brain structure and anatomical region boundary selection. A number of in vivo imaging studies have attempted to quantify age-related change in whole brain volume, grey matter, white matter and CSF compartments, using CT, 2-D MRI, and more recently high-resolution MRI morphometry.

Apart from the more obvious limitations of small cohort studies and earlier imaging techniques, as well as variability in reporting absolute or fractional volumes, the majority of these studies have been based on manual or semi-automated ROI guided measurements which may be inherently biased. This bias is introduced by the small number of regions and

metrics used in classical morphometric that are insensitive to changes elsewhere in the brain. In order to overcome these shortcomings, automated techniques have been developed the goal of which is to automatically analyze whole-brain scans, avoiding a priori selection of regions and eliminating observer variability. A number of unbiased whole brain techniques are emerging due to the improved resolution of structural MRI scans and the development of sophisticated image processing tools. There is a large body of literature on various forms of such methods but as yet ageing data is not available from large subject groups. Researchers have to develop new algorithms based on image processing to overcome above mentioned shortcomings. The developed algorithm should be able to perform well on images from different modalities, different brain morphometry and age groups. Aim of this study is to develop a database for different age groups, apply new image processing algorithms to detect atrophy automatically by various measures.

Key words: Neurological Disorders, CT and MRI, Morphometrics, Volumetrics, ROI Analysis, Image Processing.