Attenuation correction (AC) is a critical requirement for quantitative PET reconstruction. Accounting for bone information in the attenuation map (\(\mu\) map) is of paramount importance for accurate brain PET quantification. However, to measure the signal from bone structures represents a challenging task in MR. Recent \(^{(18)\text{F-FDG}}\) PET/MR studies showed quantitative bias for the assessment of radiotracer concentration when bone was ignored. This work is focused on \(^{(18)\text{F-FDG}}\) PET/MR neurodegenerative dementing disorders. These are known to lead to specific patterns of \(^{(18)\text{F-FDG}}\) hypometabolism, mainly in superficial brain structures, which might suffer from attenuation artifacts and thus have immediate diagnostic consequences. A fully automatic method to estimate the \(\mu\) map, including bone tissue using only MR information, is presented. The algorithm was based on a dual-echo ultrashort-echo-time MR imaging sequence to calculate the R2 map, from which the \(\mu\) map was derived. The R2-based \(\mu\) map was postprocessed to calculate an estimated distribution of the bone tissue. \(\mu\) maps calculated from datasets of 9 patients were compared with their CT-based \(\mu\) maps (\(\mu\) mapCT) by determining the confusion matrix. Additionally, a region-of-interest comparison between reconstructed PET data, corrected using different \(\mu\) maps, was
performed. PET data were reconstructed using a Dixon-based map (? mapDX) and a dual-echo ultrashort-echo-time-based map (? mapUTE), which are both calculated by the scanner, and the R2-based map presented in this work was compared with reconstructed PET data using the mapCT as a reference. Errors were approximately 20% higher using the ? mapDX and ? mapUTE for AC, compared with reconstructed PET data using the reference mapCT. However, PET AC using the R2-based map resulted, for all the patients and all the analyzed regions of interest, in a significant improvement, reducing the error to -5.8% to 2.5%. The proposed method successfully showed significantly reduced errors in quantification, compared with the ? mapDX and ? mapUTE, and therefore delivered more accurate PET image quantification for an improved diagnostic workup in dementia patients.

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