Influence of reconstruction parameters for FBP in semiquantification of Brain Studies with ^{123}I-FPCIT

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Introduction

Brain dopamine transporters imaging by Single Photon Emission Tomography (SPECT) with ^{123}I-FP-CIT has become an important tool in the diagnosis and evaluation of parkinsonian syndromes, since this radiopharmaceutical exhibits high affinity for membrane transporters responsible for cellular reabsorption of dopamine on the striatum.[1,2,3]

However, Ordered Subset Expectation Maximization (OSEM) is the method recommended in the literature for imaging reconstruction, Filtered Back Projection (FBP) is still used due to its fast processing, even if it presents some disadvantages. [1,2,3]

The aim of this work is to investigate the Influence of reconstruction parameters for FBP in semiquantification of Brain Studies with ^{123}I-FPCIT compared with those obtained with OSEM recommended reconstruction.

Methodology

16 exams of Brain Studies with ^{123}I-FPCIT were reconstructed by using Butterworth filter in FBP, with the cutoff frequencies (Cf) 0.4, 0 .5, and 0.6 cycles per pixel combined with the orders of 6 , 8, 10 and 15, as parameters. Regions of interest (ROI) were used to process each reconstruction following figure 1.

For OSEM reconstruction it was used 3 iterations with 8 subsets.[6] Chang's attenuation correction (μ = 0.11cm-1) was applied for both reconstruction methods, and each exam was reconstructed three times.

The outcome measure was the specific binding ratio (SBR) calculated through,

$$\text{SBR} = \frac{sum\ of\ the\ mean\ counts\ for\ each\ caudate\ and\ putamen\ - mean\ background\ counts}{mean\ background\ counts}$$ [2, 7]

For statistical analysis it the Friedman's test was used, a non-parametric approach for paired samples. [4, 5] A significance level of 5% was utilised.

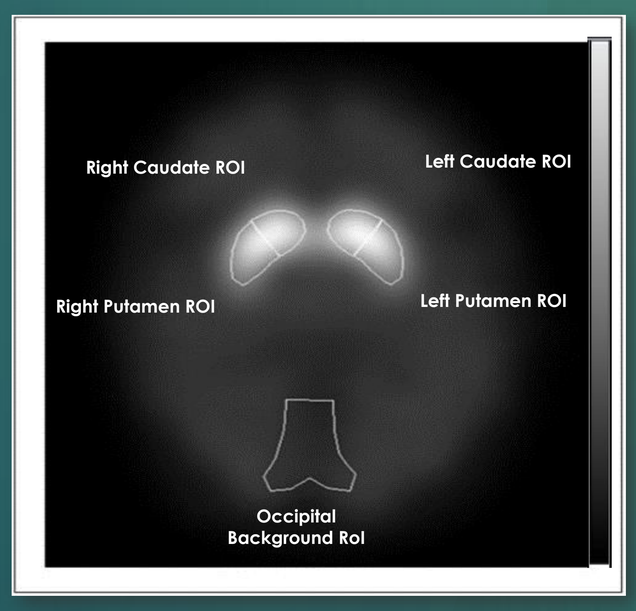

Figure 1: 5 ROIS were used, where 2 of them where positioned in the caudate (left and right) and 2 in both putamens (left and right). A ROI was also deliniated for the background positioned in the occipital.

Results

OSEM and FBP methods were compared, and for the last one with the orders 8 and 10 with 0.5Cf wasn't found any significant differences (p-value = 0.16), for any parameters variation. Those combinations of orders and cutoff frequencies produce a similar image with almost the same compromise between resolution and noise reduction. This led to conclude that both methods of reconstruction allow to identify the regions in study in a reliable way, permitting the identification of the SBR of the pathology independently of the reconstruction method. However FBP Cf 0.6 and order 6 are the parameters where FBP rates more differently from OSEM. Opposing this the Cf 0.5 and order 8 are the ones that rate the closest (Figure 2) to the gold standard for ^{123}I-FP-CIT clinical diagnostic.

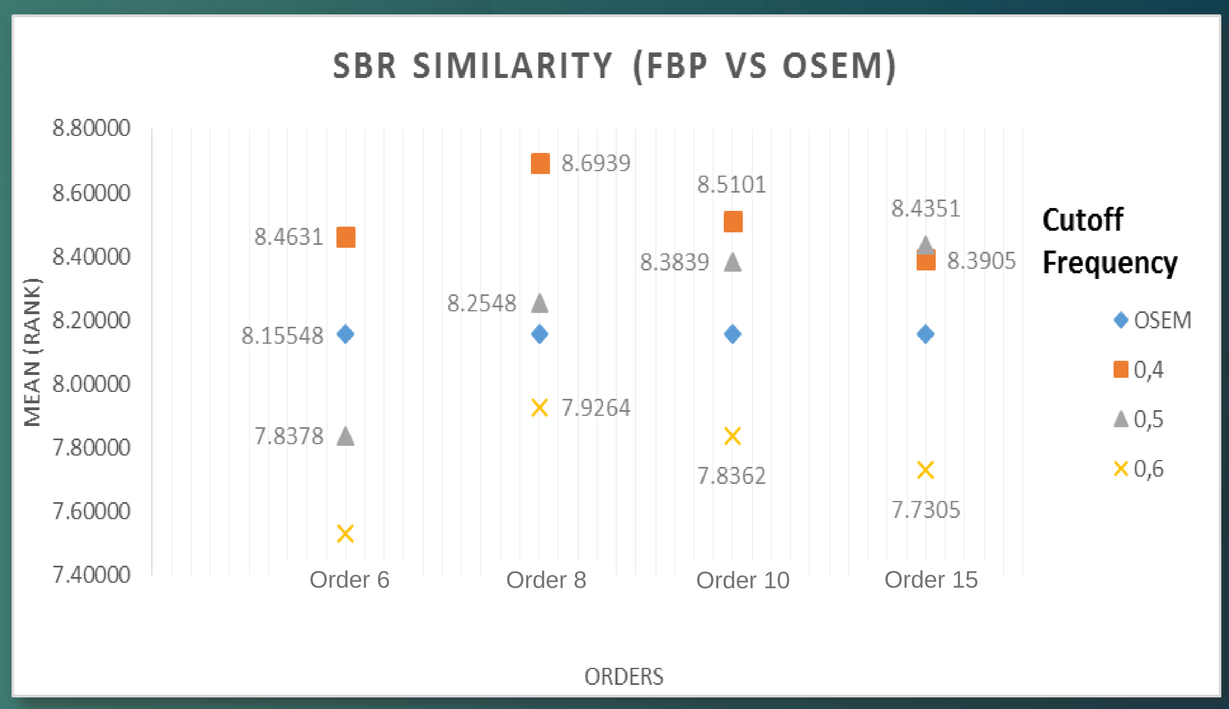

Figure 2: SBR comparasion for different orders versus different Cf for FBP and OSEM as gold standard.

Discussion/Conclusions

Both reconstruction methods can identify the regions to study, allowing identifying and classifying in similar way the SBR. Using the FBP method with Cf 0.5 and order 8 shows closer values to the ones from OSEM. Both methods with the right parameters can be used as a reliable alternative in clinical practice for the SBR calculation.

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