

Segmentation and construction of thalamus template from magnetic resonance images

Alline F. B. Camargo (IC), Daniel S. F. Magalhães (PQ), Li Li Min (PQ).

Abstract

The creation of thalamus templates assists in the study of structure, collaborating with surgical planning, giving greater structural visibility and allowing better viewing of its relation to other brain structure. Moreover the templates can be used in selective quantification in other modalities of structural and functional neuroimaging.

Key words: thalamus, segmentation, volume.

Introduction

The thalamus is characterized as a group of nuclei with ovoid shape, bilaterally placed above brainstem, in the diencephalon. Their nuclei are classified into three functional groups: transmission, association and nonspecific cores. Images of anatomical references (templates) are becoming essential, allowing better spatial resolution and better structural identification¹. This identification can be used to assist surgical planning of diseases such as Parkinson's and schizophrenia, besides its contribution as a factor diagnosis of diseases involving the thalamus. At the end of this study, it is expected to complete the segmentation of thalamic nuclei and their templates, allowing its use in clinical, diagnostic, surgical and teaching areas.

Results and Discussion

Segmentation of thalamus was manually performed using the MRICron software on T1 volumetric isotropic 1mm voxel brain imaging acquired from healthy individuals in a 3T MRI (Phillips, Achieva, Holland). We studied 30 subjects (15 women) with a mean age of 33,7 (range from 30 to 40). We used Atlas² as reference for thalamus segmentation. We found a mean (standard deviation) volume of 6441.0mm³ (292.1) for left and 6409.0mm³ (273.4) for right. An earlier study involving a volumetric analysis (FreeSurfer software) of thalamus shows a mean (SD) 7339.6mm³ (567.3) for left and 7339.2mm³ (489.3) for right³. The difference could be due to several factors, including protocol acquisition, anatomical reference used, ways of segmentation (manual versus automatic), type of software (edge-tracing versus, voxel-by-voxel), socio-cultural or even a daily fluctuation as in recent report of a large sample showing that subjects' brains are larger in the morning⁴. All these can explaining in part the volumetric differences seen in segmentation studies⁵. The thalamic templates once fused to form a mean template can be applied onto other structural and functional neuroimaging in other to extract selective data (See Figure 1).

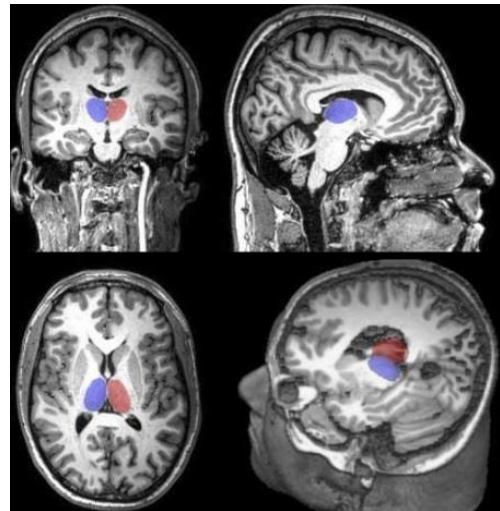


Figure 1. Multislice and 3D imaging of thalamic segmentation. The VOIs has been smoothed.

Conclusions

We were able to segment manually thalamus and to produce a template that can be used for other modalities of structural and functional neuroimaging.

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