

Introduction

Dynamic susceptibility contrast (DSC) perfusion MRI has been widely applied to assess ischemia in small animal stroke models. Quantitative CBF estimation requires deconvolution of the tissue concentration time curves with an arterial input function (AIF). However, image-based determination of AIF in rodent is challenging due to limited spatial resolution. We evaluated the feasibility of automated AIF detection and compared the results with those obtained from commonly applied semi-quantitative analysis.

Methods

Permanent occlusion of bilateral common carotid artery was used to induce ischemia in a spontaneous hypertensive rat (240gm, 12-week). DSC imaging was performed on a 3-T MR scanner, using a wrist coil, with a SE-EPI sequence (TR/TE = 700/80 ms, FOV = 41 mm, matrix = 64, 3 slices, SW = 2 mm), starting from 7 s prior to contrast injection (1.2ml/kg, Schering AG). The experiment was performed at pre-operation, 1-day, 1-week and 4-week post-operation. For quantitative analysis, AIF was obtained from 10 voxels with greatest contrast enhancement and used for deconvolution. For the semi-quantitative analysis, relative CBF was estimated by the integral divided by the first moment of the relaxivity time curves.

Results

No significant differences were observed between the AIF obtained in three different ROIs, whole brain, hemisphere without lesion and hemisphere with lesion. Comparing the CBF ratios (lesion/normal) between quantitative and semi-quantitative analyses, a similar trend at different operative time points was found.

Discussion

The automated method was able to detect AIF with similar shapes as could be found in literatures. In this study, arterial inputs to hemispheres with and without lesion were found to be similar, thus the quantitative analysis led to comparable CBF ratios than the semi-quantitative analysis. However, when the regional blood supply is altered, being capable of determining local AIF will be crucial for the accurate assessment of ischemia status.