Effect of secretin stimulation in healthy volunteers at 3T: comparison of mono- and biexponential (IVIM) models in pancreas diffusion-weighted imaging

Julie Absil1, Helena Torrao1, Thierry Metens1, Monia Bali1, and Celso Matos1

1MRI Unit - Radiology, CUB Hôpital Erasme, Brussels, Brussels, Belgium

Objective: To prospectively quantify Intravoxel Incoherent Motion (IVIM) parameters as well as monoexponential DWI parameters in healthy pancreas and assess changes during secretin stimulation.

Methods: In this IRB approved study, fifteen healthy volunteers underwent 3T diffusion-weighted SE-EPI MRI (b-values: 0, 25, 50, 100, 500, 1000 s/mm², expiratory triggering) before and at 3 and 8 minutes following secretin injection (1CU/KgBW). Apparent diffusion coefficient (ADC) values were obtained with monoexponential regressions using all b-values (ADCtot), b-values from 0 to 100 s/mm² (ADClow) and b-values from 100 to 1000 s/mm² (ADChigh); perfusion fraction f and pseudo-diffusion coefficient D* were derived from a biexponential fit according to S(b)/S0 = f exp(-bD*)+(1-f) exp(-bD) with D fixed to ADChigh value.

Results: The mean ADCtot, ADClow, ADChigh (D) and f significantly increased at 3 minutes after secretin administration: ADCtot increased from 1271±101 to 1434±142 μm²/s (P<0.001), ADClow increased from 3162±737 to 3949±933 μm²/s (P<0.001), ADChigh (D) increased from 1124±90 to 1223±126 μm²/s (P=0.003); f increased from 0.23±0.07 to 0.30±0.09 (P=0.012) while D* significantly decreased from 36203±13378 to 26074±8861 μm²/s (P<0.05). All parameters except D* decreased between 3 and 8 minutes after secretin administration. Fig.1 summarizes the parameters variations and Table 1 and 2 give the mean values of all calculated parameters and the results of the Wilcoxon’s tests for paired comparisons.

Conclusions: Using both monoexponential and biexponential models, diffusion coefficients and the perfusion fraction increased significantly at 3 minutes after secretin administration, reflecting the expected increase in both perfusion and the exocrine free water release.