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Interobserver variability in quantitative analisys of cerebrospinal flow using phase contrast magnetic resonance imaging

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Purpose: In any quantitative analysis of cerebrospinal flow (CSF) through the Aqueduct of Sylvius by means of phase contrast magnetic resonance imaging (PC-MRI), diverse sources of error may lead to inaccuracies in the calculus of the different parameters that characterize the motion of CSF (mean flow, mean velocity and stroke volume). Some of these are the presence of partial volume effect (PVE) or aliased pixels, although the most important will be the method used to select the region of interest (ROI) [1-3].

The use of a conventional manual method to define the ROI will introduce a great variability in the results due to that manual selection of the region of interest (Figure 1). The aim of this work is to verify whether our semiautomatic method to detect the region of interest (ROI) reduces the interobserver variability that exists during the selection of the ROI for the conventional method.

Subjects and Methods: The reproducibility of our method was evaluated and compared with the conventional manual method for two observers analysing 21 healthy subjects. MR examinations were performed using a 1.5 T scanner with a phase contrast sequence and the following parameters: Venc = 20 cm/s, FOV = 160 mm, 3 mm slice thickness, matrix size = 256 x 256, TR = 53 ms, TE = 11 ms, NSA = 2, flip angle = 15º and 20-27 frames per cardiac cycle with peripheral retrospective gating. The method was developed using MATLAB R7.

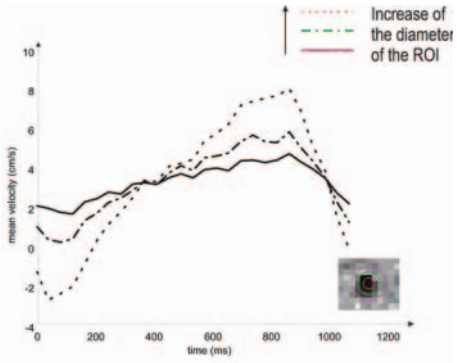
Results: Differences in outcomes between the two observers are expressed in terms of mean flow, stroke volume, standard deviation and the systematic difference (sys diff), parameter defined as the difference between the mean values obtained for every observer.(Table 1).

The model was highly reproducible. The measurements using the semiautomatic method reduced the interobservers variability (systematic difference = 0.0 for stroke volume and 0.01 for volumetric flow rate) versus the conventional manual method (systematic difference = 5.46 for stroke volume and 0.05 for mean flow rate).

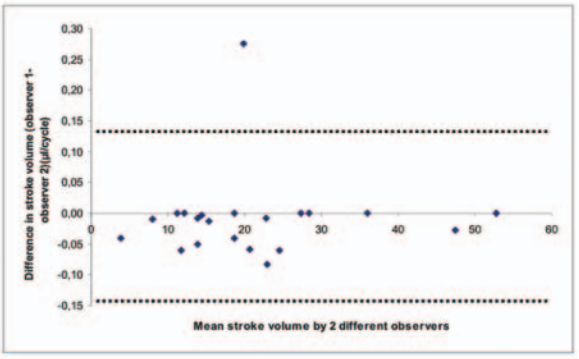
Conclusions: Our finding demonstrate that our semiautomatic method is significantly more reproducible than the manual detection procedure. Our method allow a generalization of the calculus of flow parameters with great consistency and independency of the operator (Figure 2).

References:

1. FR Korosec et al. *Int J Neuroradiol* 1997; 3: 293-318.
2. NJ Pelc. *Magn Reson Imaging Clin N Am* 1995 3: 413-424
3. G Greil et al. *J Magn Reson Imaging* 2002 15: 47-54



	Manual method			Semiautomatic method		
	Observer 1 (Mean ± SD)	Observer 2 (Mean ± SD)	Sys Diff	Observer 1 (Mean ± SD)	Observer 2 (Mean ± SD)	Sys Diff
Stroke volume (µl/cycle)	21.90 ± 9.66	27.36 ± 16.39	5.46	21.16±12.18	21.16±12.18	0.0
Flow rate (ml/min)	1.51 ± 0.59	1.46 ± 0.78	0.05	1.45±0.79	1.47±0.78	0.01



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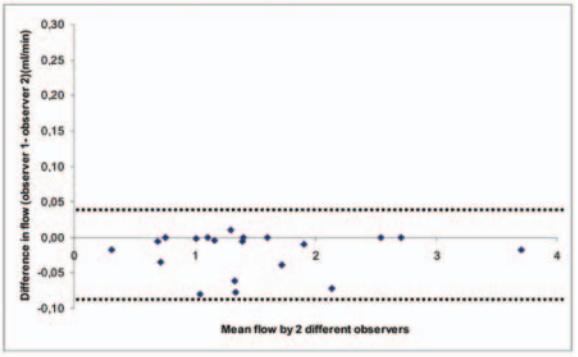

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