Sulcal opening in behavioural variant Frontotemporal dementia: comparison between automated and manual measures

Giorgio G Fumagalli[1,2], P Basilico [1], A Arighi [1], M Scarioni [1], T Carandini [1], L Ghezzi [1], A Pietroboni [1], M Mercurio [1], E Scarpini [1], D Galimberti [1]

[1]Dipartimento fisiopatologia medico-chirurgica e dei trapianti, Università degli studi di Milano, Italy [2] Dipartimento Neuroscienze, psicologia, area del farmaco e salute del bambino, Università degli studi di Firenze, Italy

Introduction:

Behavioural variant Frontotemporal dementia (bvFTD) is a neurodegenerative disease characterized radiologically by frontal and/or temporal atrophy. Sulcal opening is an indirect way to assess brain atrophy. Visual rating scales are a quick, easy to learn and economic way to assess sulcal widening.
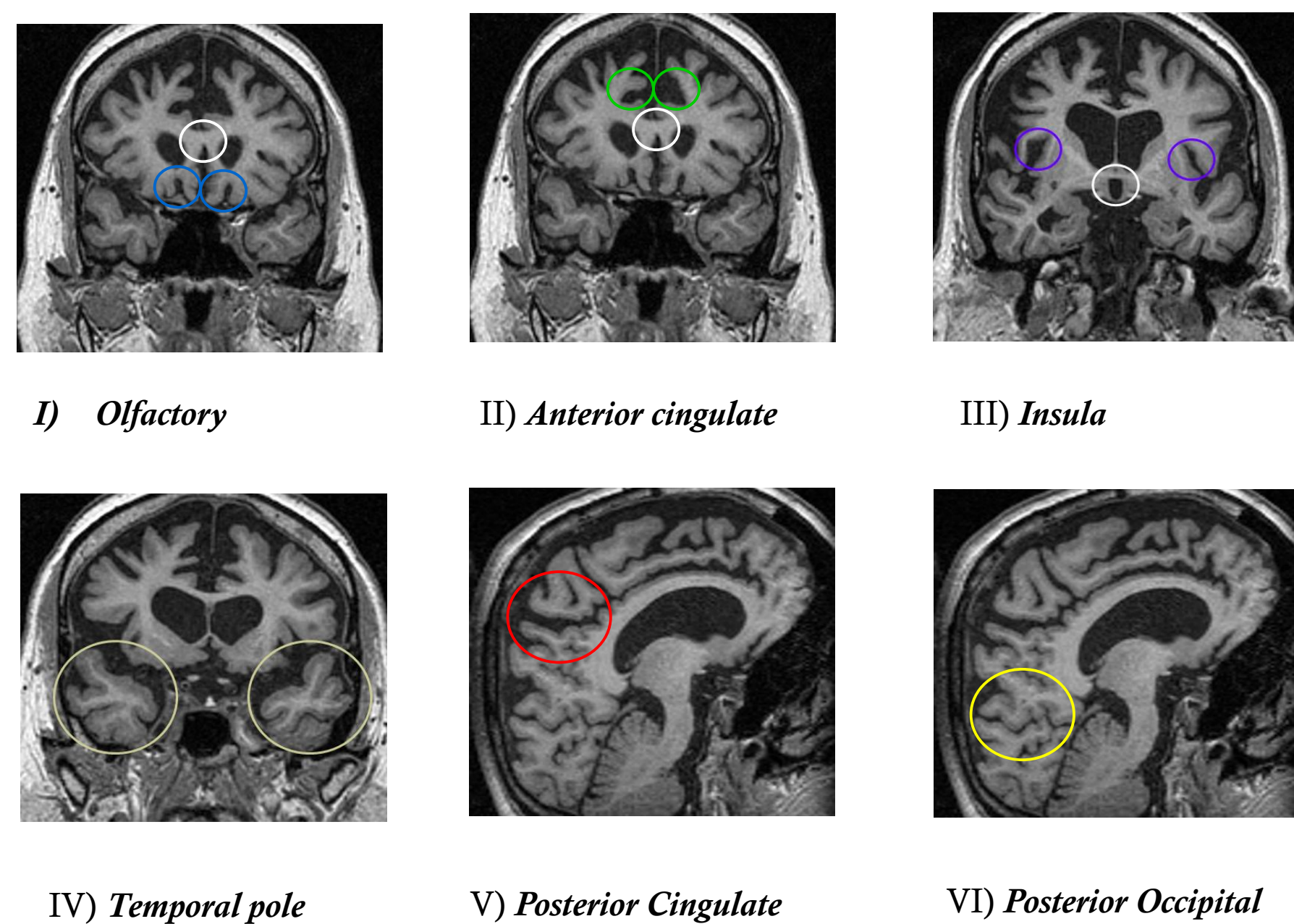
Aims:

Evaluate the discriminating power and applicability of sulcal opening in the diagnosis of behavioural variant Frontotemporal dementia (bvFTD).
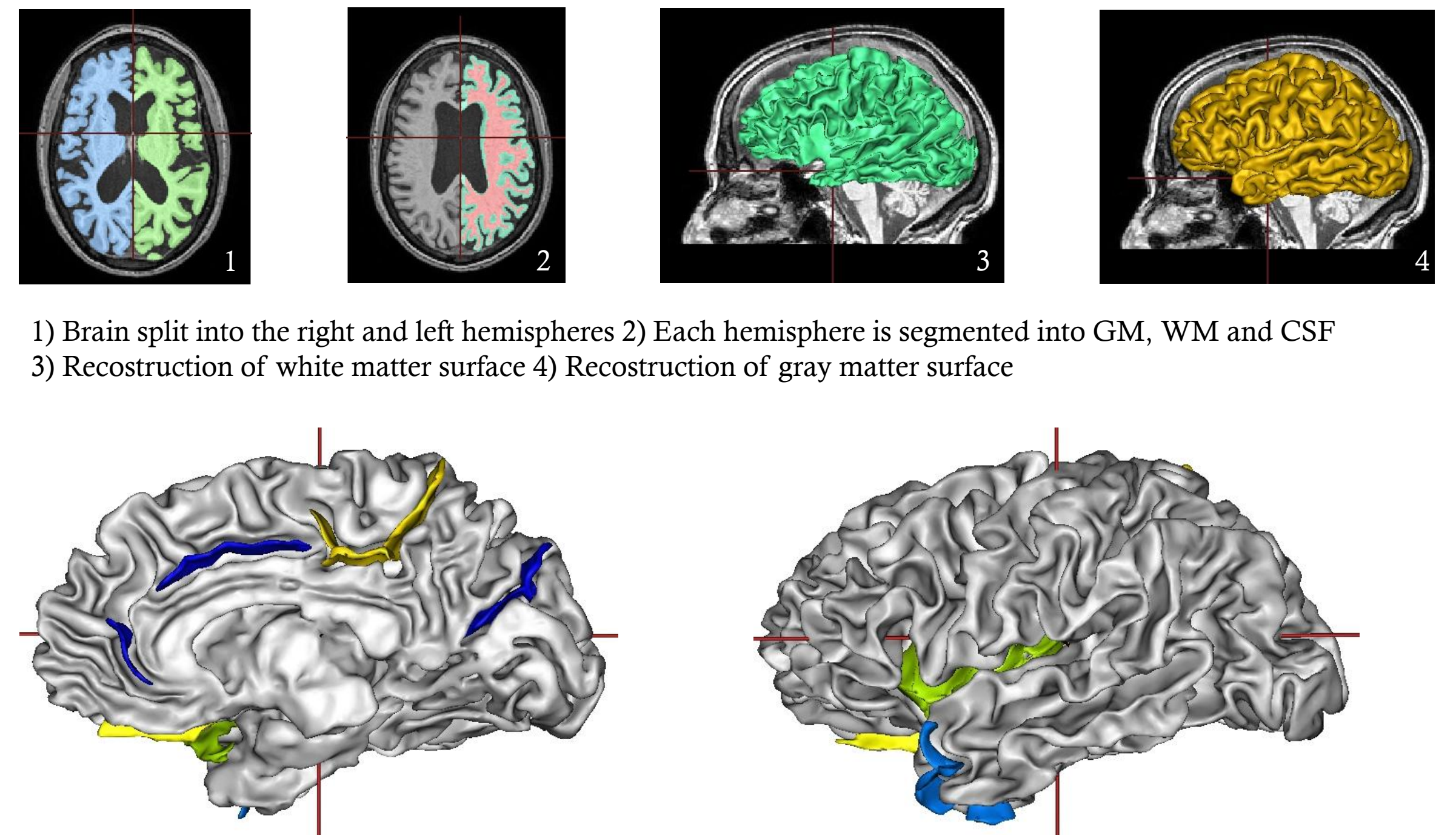
Methods:

MRI of twenty-three patients with bvFTD, and of 14 controls were compared. For each subject, 12 cortical sulci (olfactory, anterior and posterior cingulate, parietaloccipital, insula and temporal pole sulci, both sides) were reconstructed and automatically identified using Brainvisa software. Moreover, to test the applicability in clinical practice, visual rating scales for each sulcus were applied by two raters. Sulcal span and visual rating results for each sulcus were compared between FTD and controls using T test with Bonferroni correction and the area under receiver operating curve (AUC) was calculated.

Atrophy Rating Scales:

I) *Olfactory*   II) *Anterior cingulate*   III) *Insula*

IV) *Temporal pole*   V) *Posterior Cingulate*   VI) *Posterior Occipital*

Brainvisa software:

1) Brain split into the right and left hemispheres 2) Each hemisphere is segmented into GM, WM and CSF
3) Recostruction of white matter surface 4) Recostruction of gray matter surface

The six identified sulci were: Olfactory (yellow), Anterior cingulate (blue), Temporal pole (light blue), Insula (green), Posterior cingulate (gold), Posterior occipital (blue).
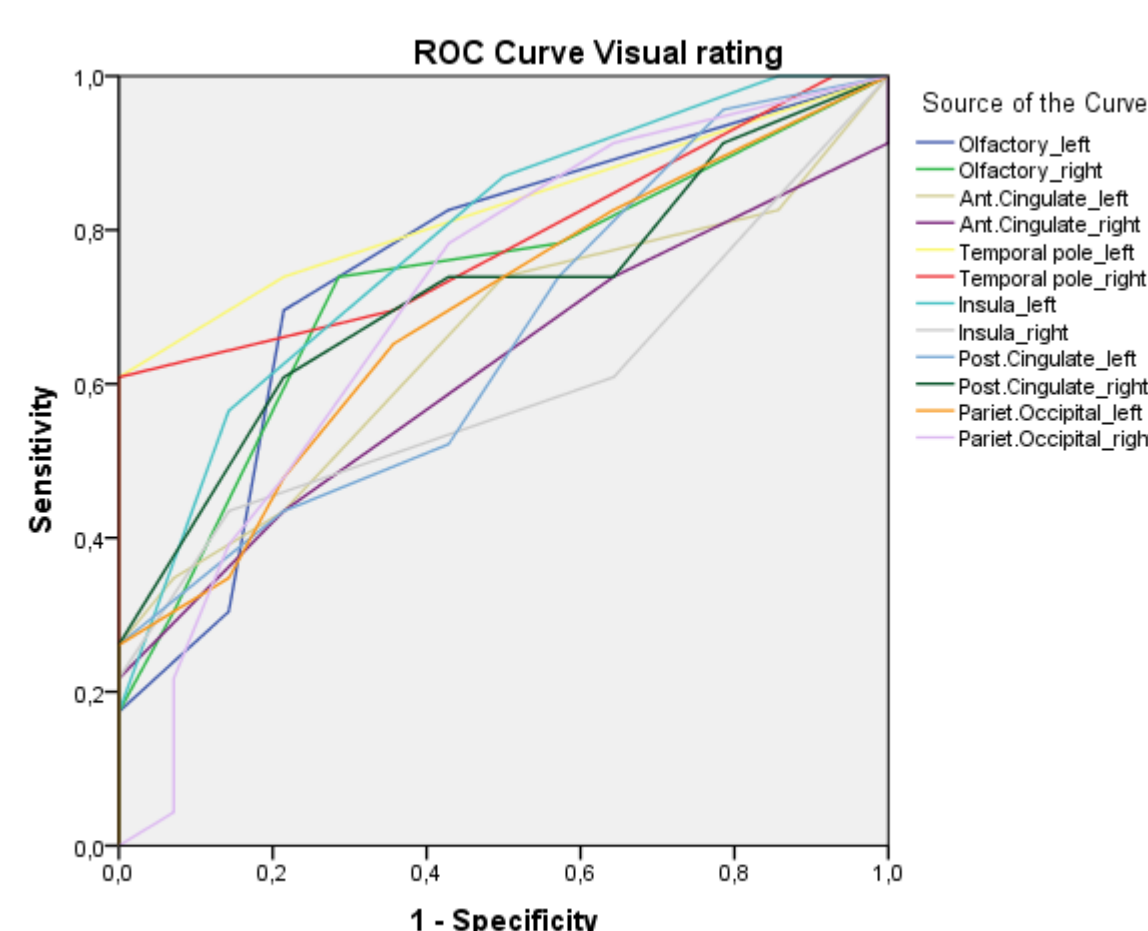
Results:

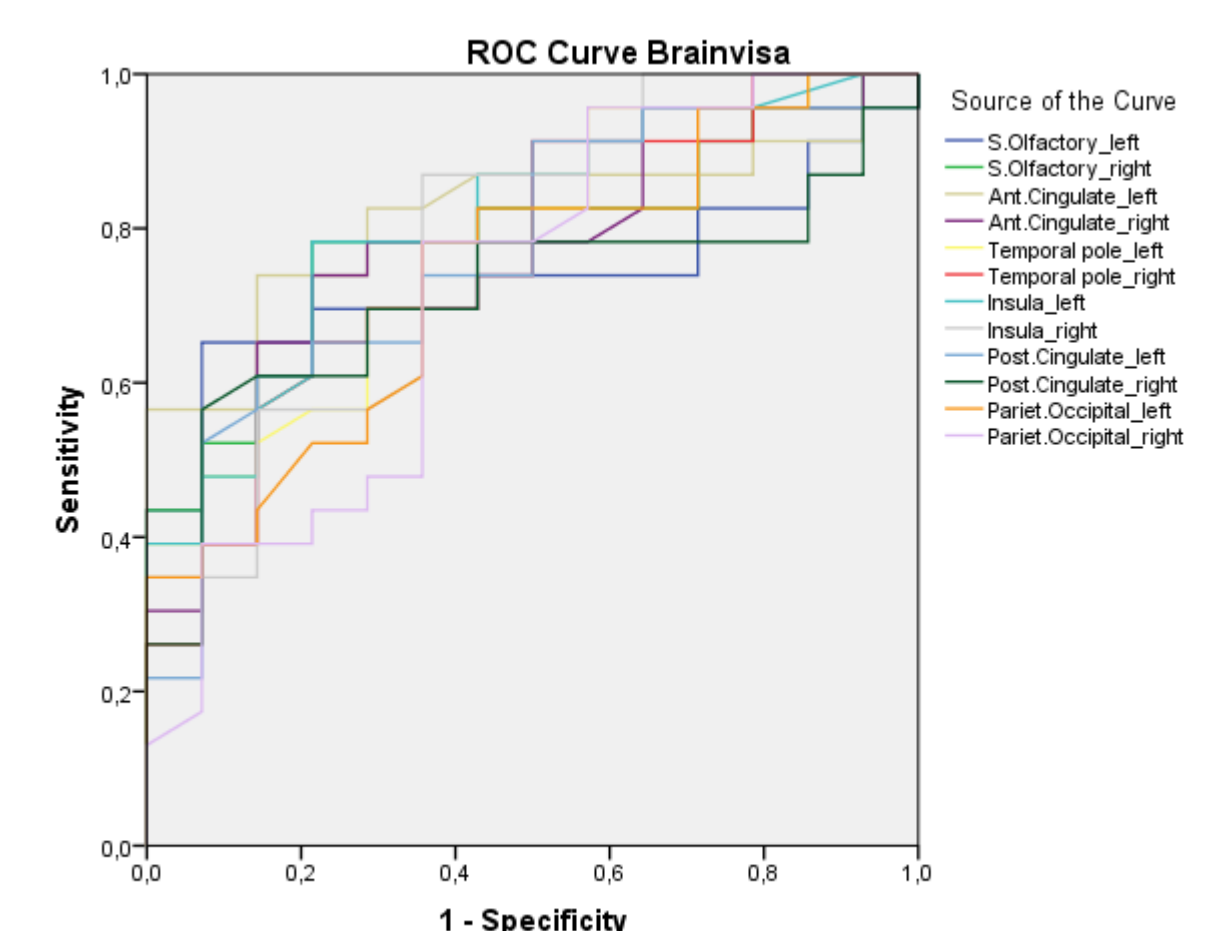| SULCAL OPENING VISUAL RATING						
	FTD		CON		Sig	AUC
Sulcus	Mean	Standard Deviation	Mean	Standard Deviation	(A)	(B)
Olfactory_left	1,1	0,9	0,4	0,6	B	0,755
Olfactory_right	1,1	0,9	0,5	0,5	B	0,728
Ant.Cingulate_left	1,4	1,1	0,8	0,6		0,655
Ant.Cingulate_right	1,3	0,8	0,9	0,4		0,616
Temporal pole_left	1,5	1,0	0,6	0,2	B	0,828
Temporal pole_right	1,5	1,0	0,6	0,3	B	0,789
Insula_left	1,8	0,5	1,2	0,5	B	0,786
Insula_right	1,7	0,7	1,4	0,3		0,595
Post.Cingulate_left	1,5	0,9	1,0	0,8		0,658
Post.Cingulate_rigth	1,7	1,0	1,0	0,7	B	0,719
Pariet.Occipital_left	1,3	1,0	0,7	0,7	B	0,691
Pariet.Occipital_right	1,4	0,9	0,8	0,9	B	0,713

Using the automated method, bvFTD patients were found to have more opening in all sulci analized. Visual rating scales showed that bvFTD had more sulcal opening in olfactory and temporal pole both sides, left insula, right posterior cingulate and right parietaltoccipital. Similar AUC were obtained with the two methods, in particular the highest AUC for the automated method was the left anterior cingulate (0.814), whereas for the visual rating was the left temporal pole (0.828).

SULCAL OPENING BRAINVISA						
	FTD		CON		Sig	AUC
Sulcus	Mean	Standard Deviation	Mean	Standard Deviation	(A)	(B)
Olfactory_left	2,25	0,96	1,56	0,35	B	0,736
Olfactory_right	2,53	1,14	1,59	0,38	B	0,789
Ant.Cingulate_left	2,27	1,04	1,36	0,45	B	0,815
Ant.Cingulate_right	2,34	1,27	1,39	0,52	B	0,775
Temporal pole_left	2,61	0,82	1,79	0,70	B	0,778
Temporal pole_right	2,57	0,94	1,70	0,72	B	0,762
Insula_left	2,54	0,69	1,78	0,55	B	0,809
Insula_right	2,54	0,72	1,81	0,56	B	0,781
Post.Cingulate_left	2,52	0,97	1,78	0,71	B	0,769
Post.Cingulate_rigth	2,64	1,05	1,91	0,63	B	0,713
Pariet.Occipital_left	1,91	0,63	1,36	0,46	B	0,738
Pariet.Occipital_right	1,78	0,50	1,36	0,50	B	0,720

Discussion:

Both methods have demonstrated the utility of sulcal opening in the differentiation between bvFTD and controls. Despite differences, especially in the opening of anterior cingulate sulci, most of the results obtained with the visual rating were confirmed with the automated method. Future studies should compare bvFTD with other form of dementia.

Conclusion:

Sulcal opening can be helpful for the diagnosis of bvFTD and visual rating scales can be an easy and economic way to assess it and can be used in the clinical setting to improve the diagnostic accuracy.

References:
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Contact: giorgiofumagalli@gmail.com