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Comparison of the accuracy of quantitative automatic and radiological imaging markers in distinguishing Parkinson Disease and Progressive Supranuclear Palsy

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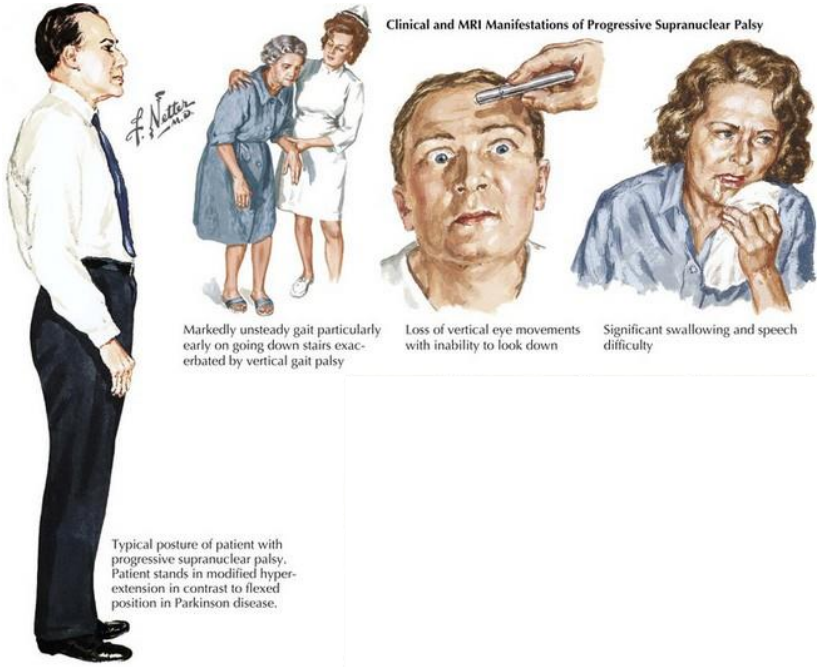
I do not have any conflict of interest to disclose

Introduction

Progressive Supranuclear Palsy (PSP):

- Vertical gaze palsy
- Unsteady gait
- Frequent falls
- Speech and cognitive impairment



Introduction

Most reliable indexes: M/P ratio, MRPI/MRPI 2.0

MRPI	MRPI 2.0
$MRPI = \frac{P\ x\ MCP}{M\ x\ SCP}$	$MRPI\ 2.0 = MRPI\ x\ \frac{3rdV}{FH}$
P: pons area; MCP: medium cerebellar peduncle width; M: midbrain area; SCP: superior cerebellar peduncle width; 3rdV: 3° ventricle width; FH: frontal horns of lateral ventricles	

Quattrone A, Morelli M, Nigro S, Quattrone A, Vescio B, Arabia G, et al. A new MR imaging index for differentiation of progressive supranuclear palsy-parkinsonism from Parkinson's disease, Parkinsonism and Related Disorders (2018)

Purpose

1. To compare the accuracy of imaging markers measured by QyScore®, an FDA and CE marked medical device, and radiological assessment in distinguishing parkinson disease (PD) from progressive supranuclear palsy (PSP) patients
2. Any other indexes able to differentiate PD from PSP?

Methods

- 9 PSP patients
- 18 PD patients

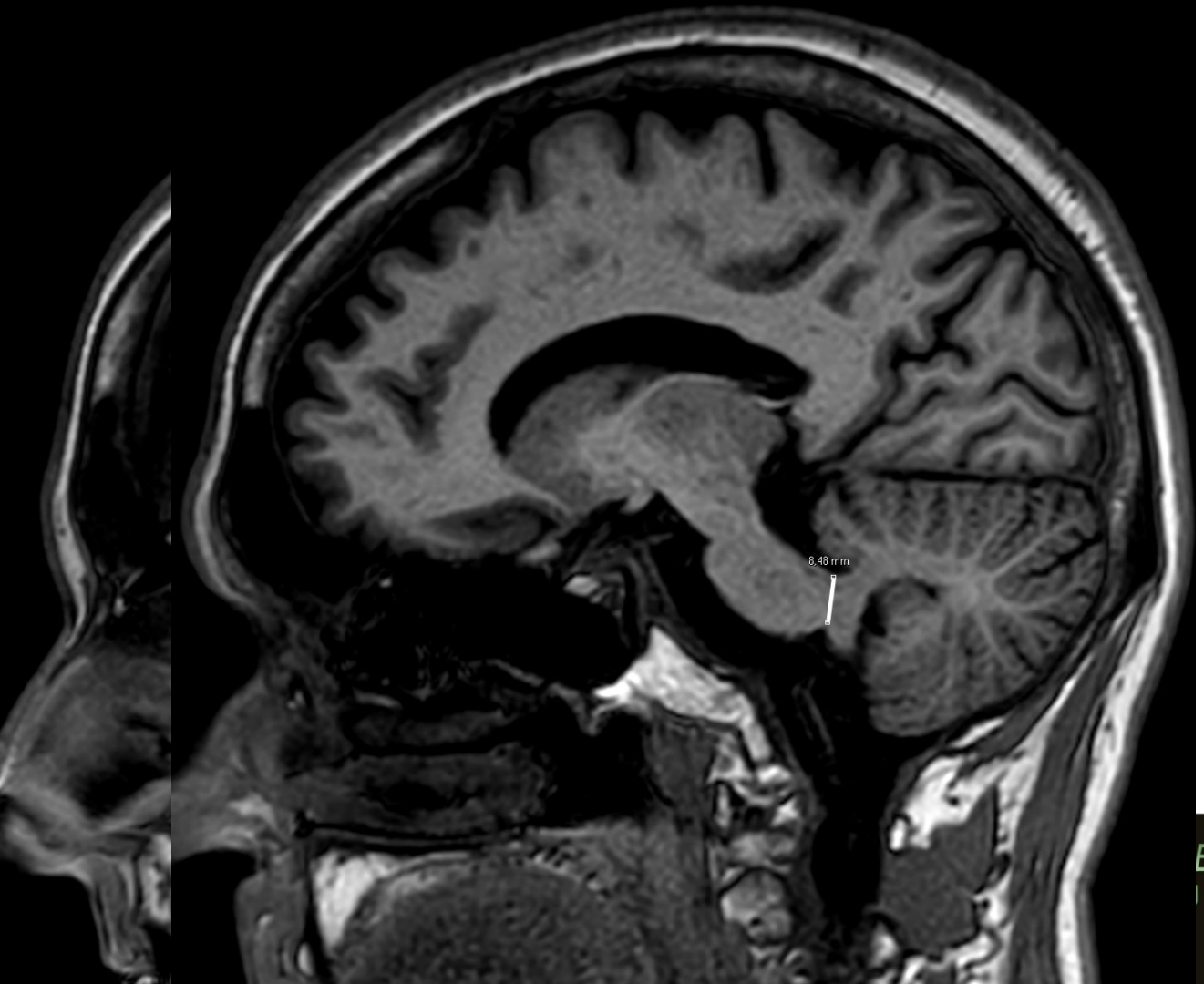
- 25 healthy patients

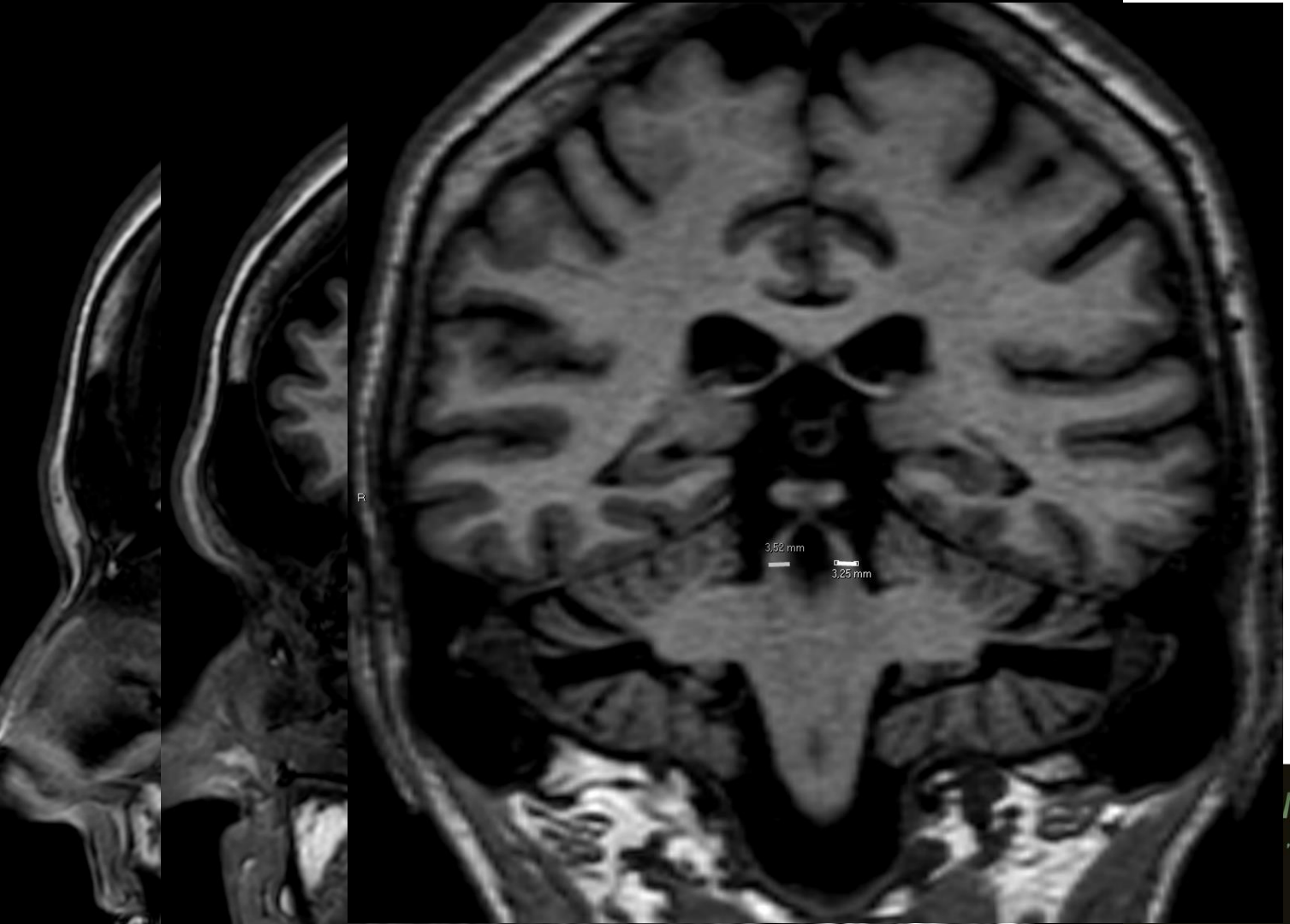
52
T1-3D brain MRIs

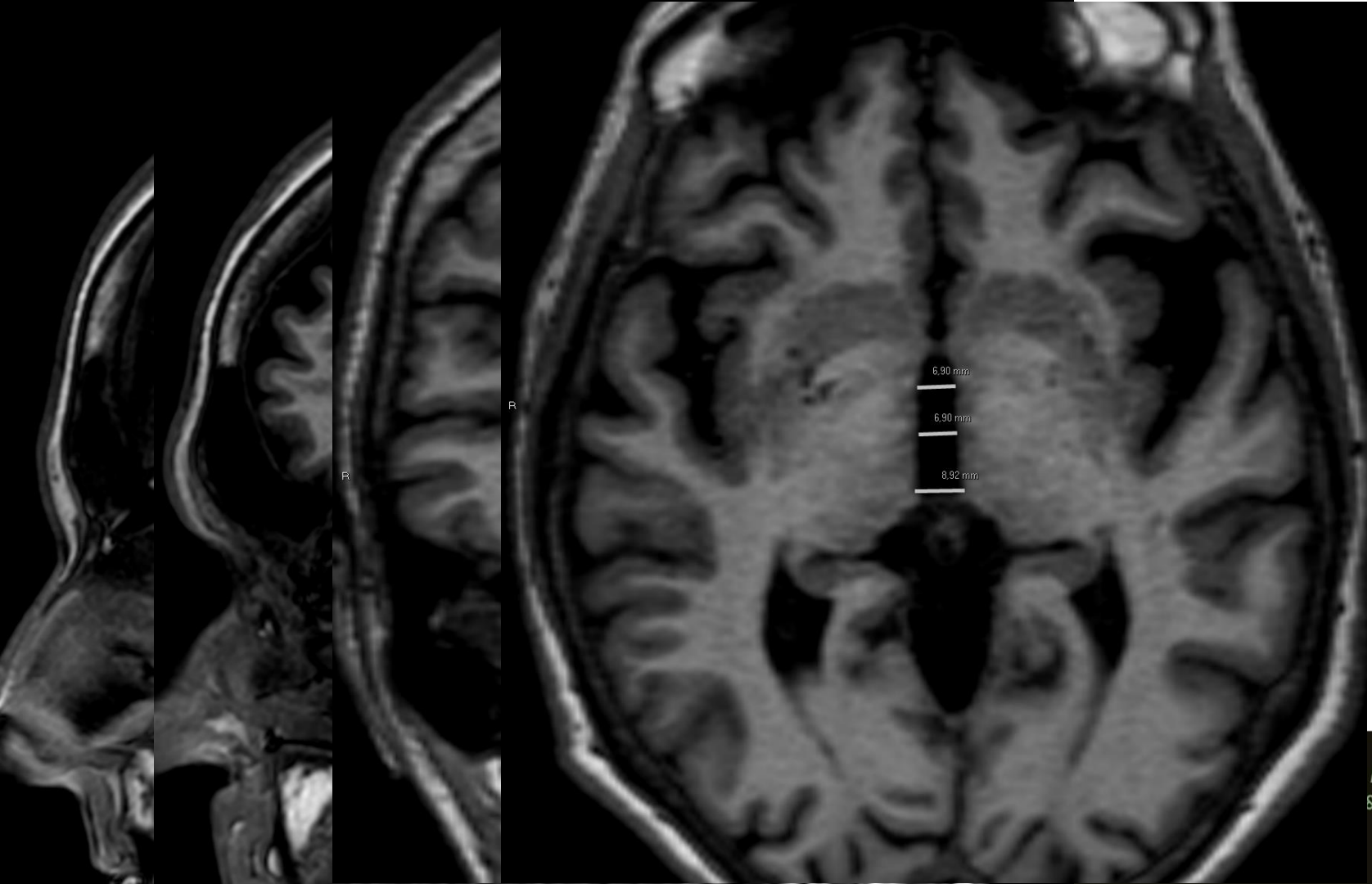
Methods – radiological evaluation

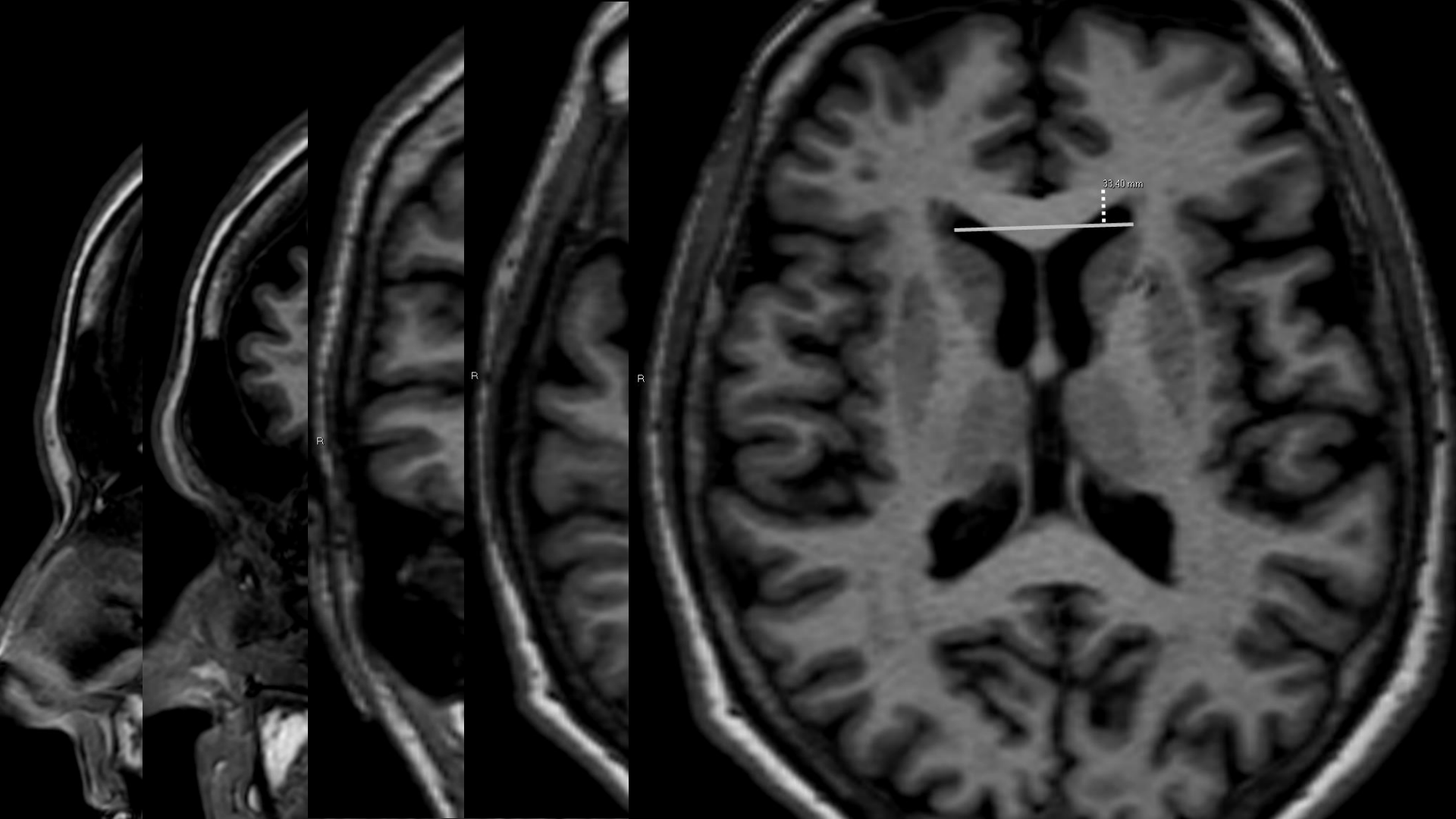
M surface	3rdV	GcerbA
P surface	FH	BGA
M/P	MRPI	GCA
MCP	MRPI 2.0	MTA
SCP		


AR: 75,71 mm²
MED: 739,01
DS: 6,50
Intervallo: 117,75 - 1062,79
AR: 511,52 mm²
MED: 850,04
DS: 62,91
Intervallo: 33,21 - 1262,06





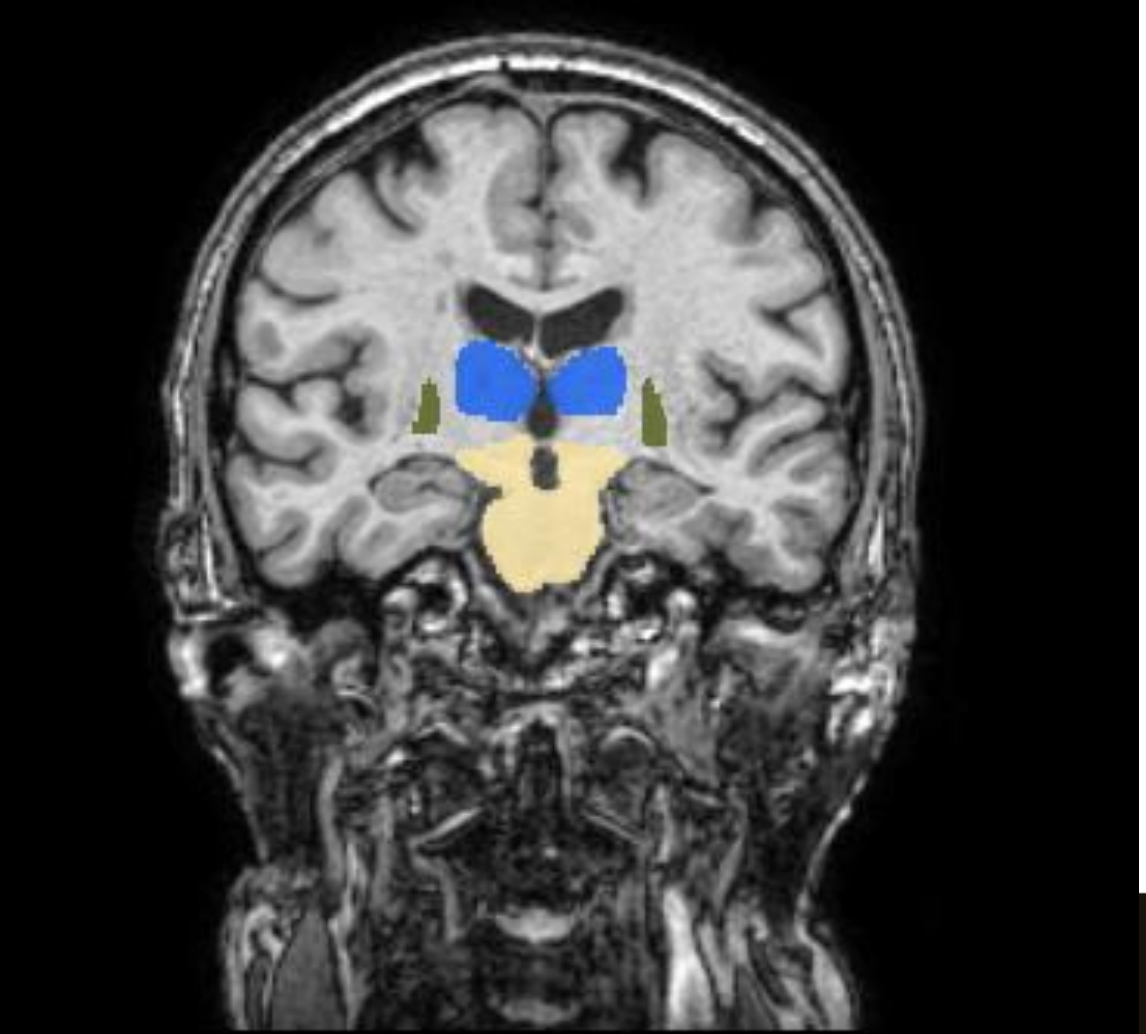


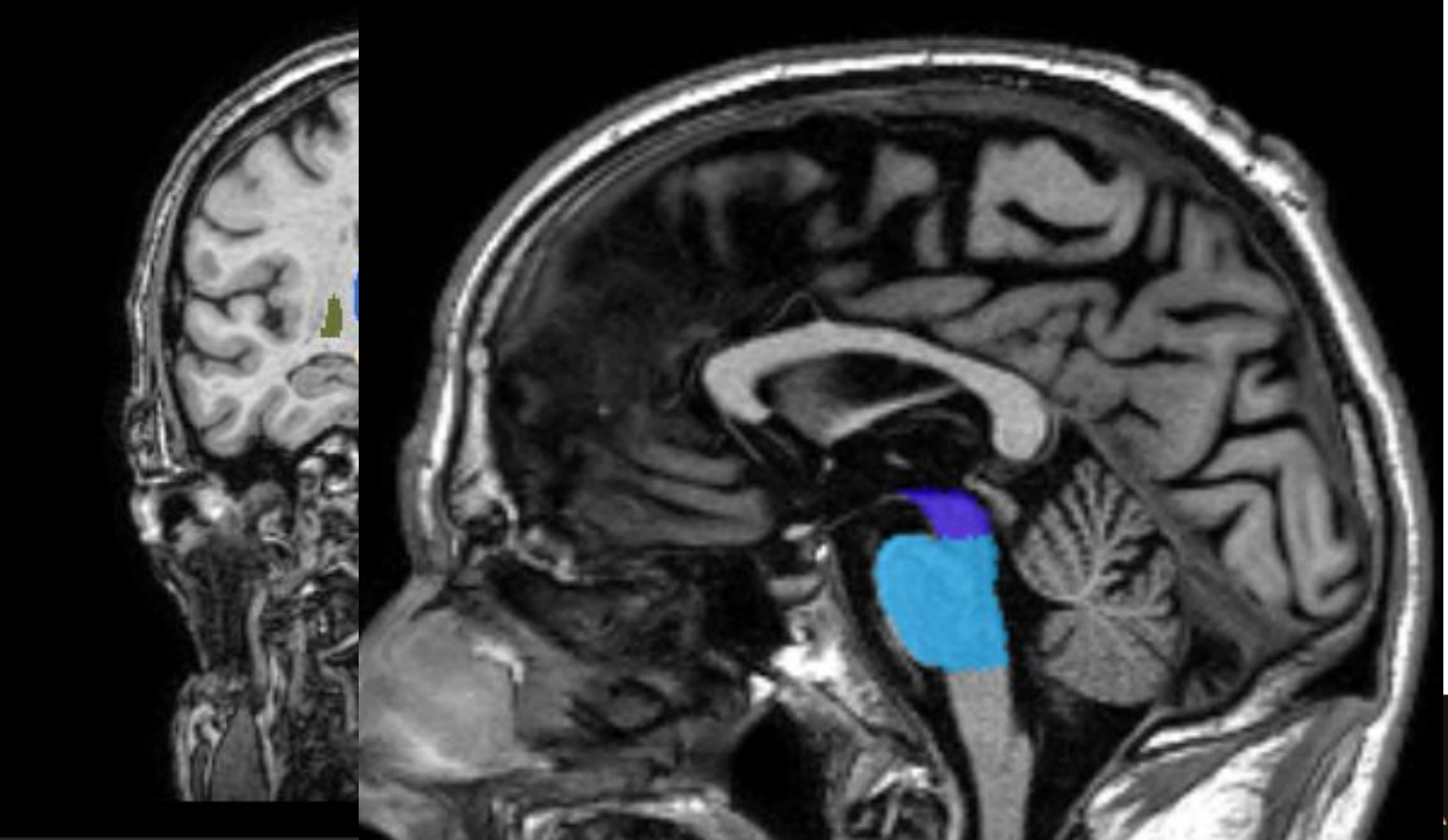

R
R
R
33.40 mm

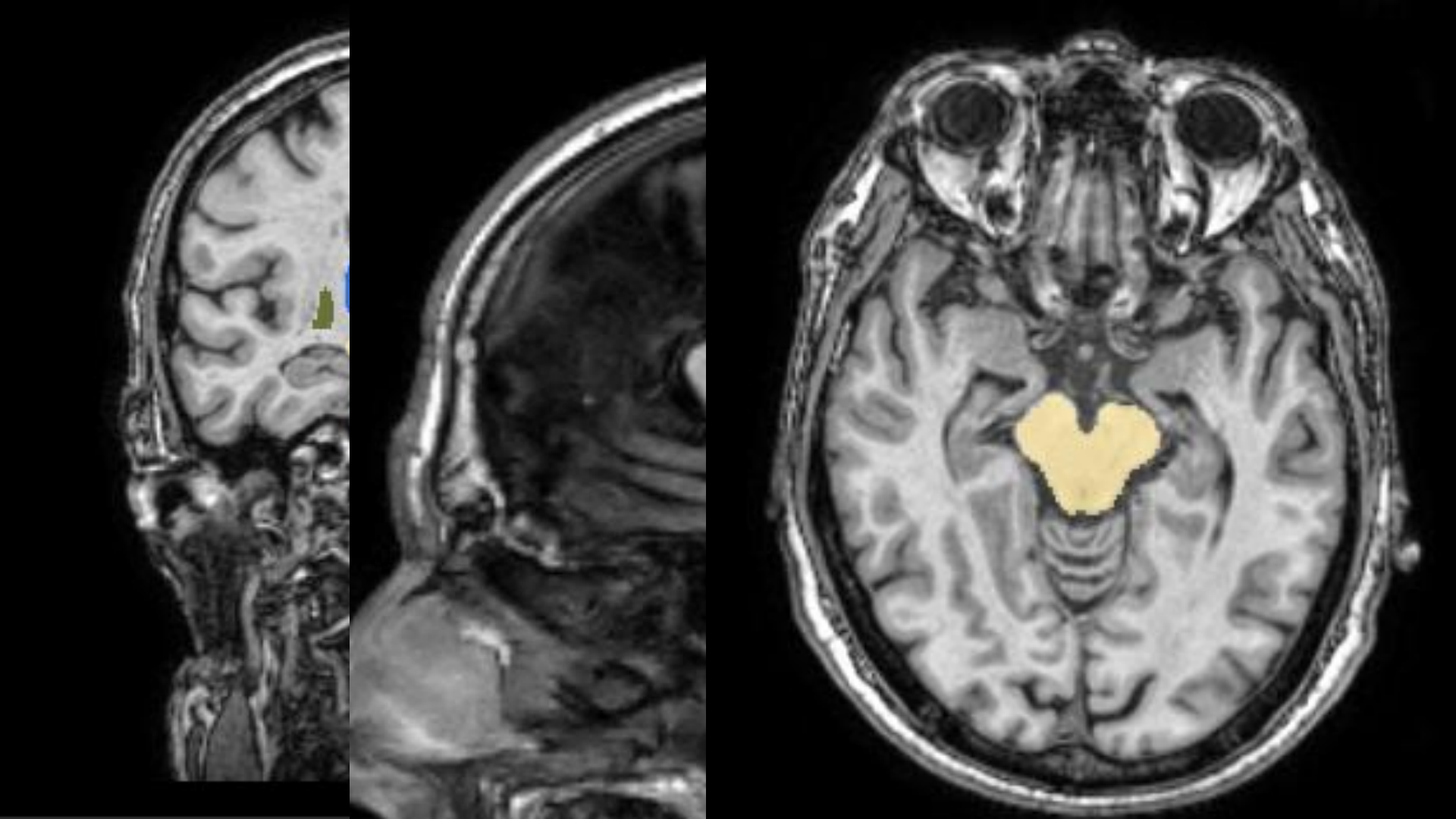
Methods – authomated analysis

1st step: QyScore® software automatically segmented 17 brain structures, providing volumes and population-normed z-scores. The accuracy of the latter was compared with visual radiological assessment performed by an expert neuroradiologist;

2nd step: An automatic MRPI was developed by Qynapse and compared with the visual MRPI calculated by an expert neuroradiologist;
Metrics have been compared using Kruskal-Wallis test, Benjamini-Hochberg method.
Overall diagnostic accuracy estimated as the area under the receiver operator curve with 95% CI



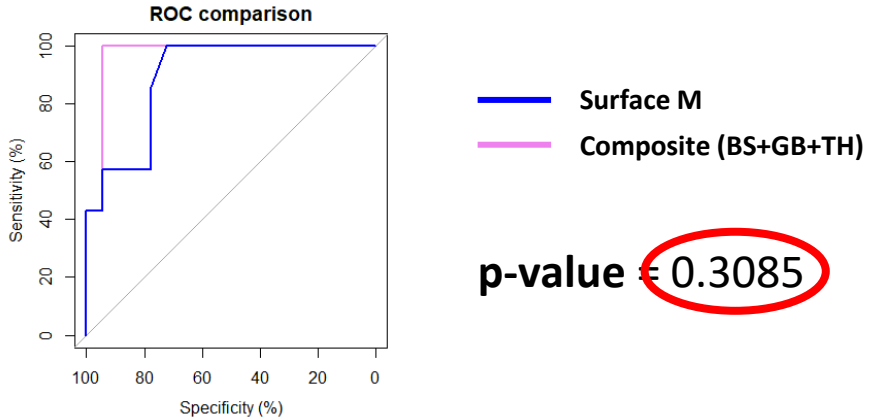




Results – 1° step

PD vs PSP	
Radiological evaluation	**QyScore evaluation**
Surface M (p=0.003)	Brainstem (p<0.001)
M/P (p=0.005)	Globus Pallidus (p<0.001)
MRPI (p=0.005)	Thalamus (p<0.001)
MRPI2.0 (p=0.003)	Amygdala (p<0.001)
PCM Diameter (p=0.046)	
PCS Diameter (p=0.033)	

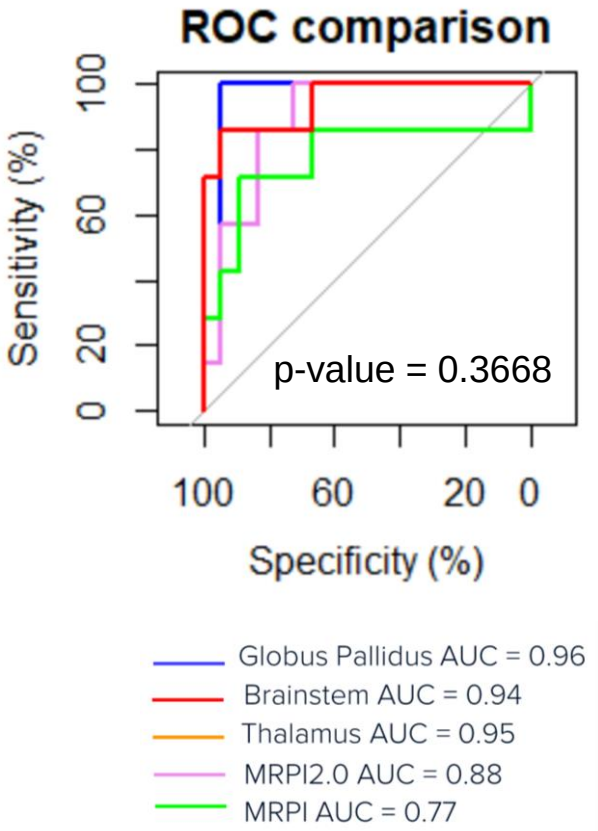
	PD vs PSP	AUC
QyScore markers	Brainstem	0.9444
	Globus Pallidus	0.9603
	Thalamus	0.9524
	Composite (BS+GB+TH)	0.9683
Manual Indexes	Surface M	0.8929
	MRPI2.0	0.8889



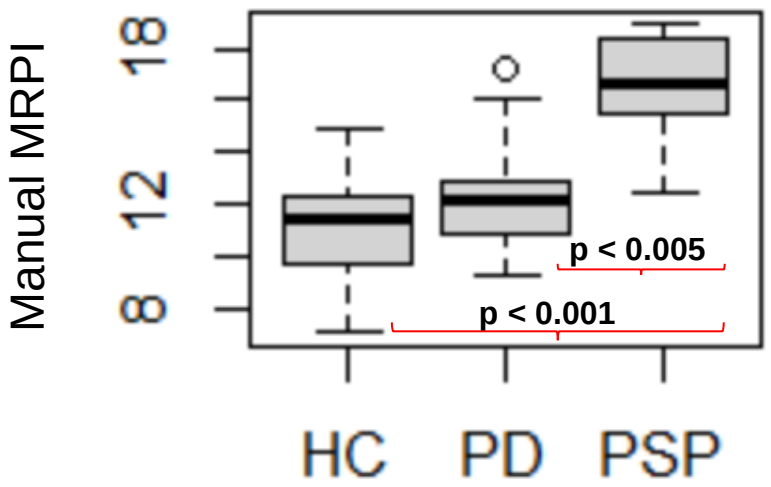
p-value = 0.3085

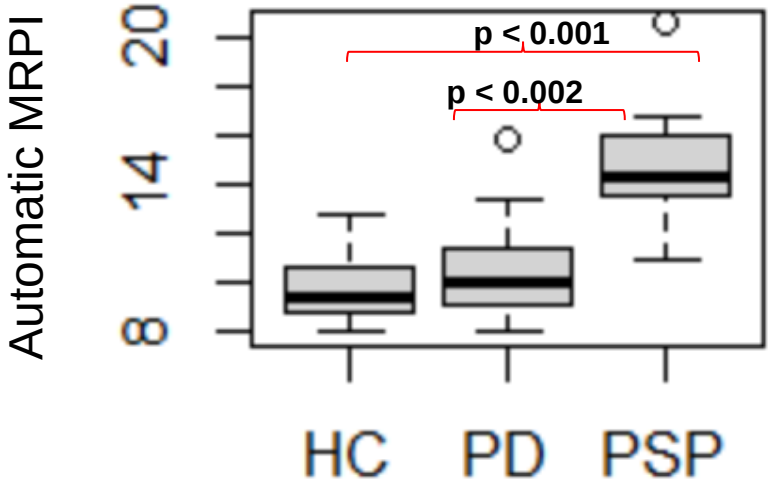
Results – 1° step

	PD vs PSP	Sensitivity	Specificity
QyScore® markers	**Brainstem z-score**	0.857	0.944
	Globus Pallidus z-score	1.000	0.944
	Thalamus z-score	1.000	0.944
Radiological Assessment	**MRPI2.0**	1.000	0.722
	MRPI	0.714	0.888



Results – 2° step

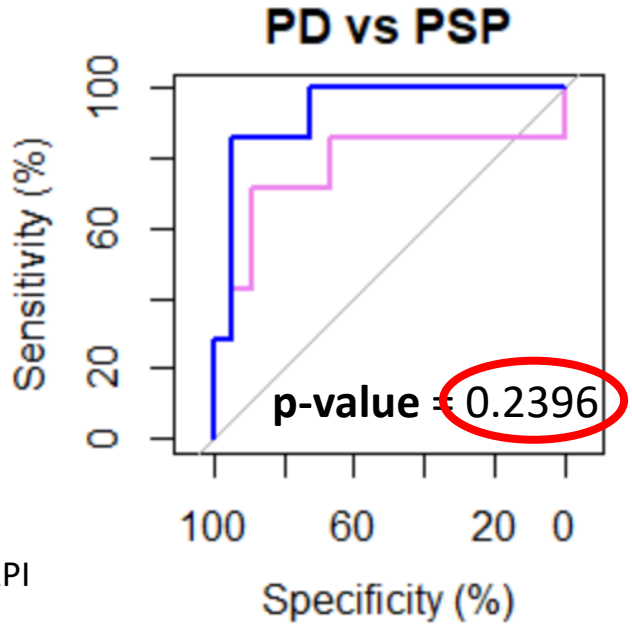




Results – 2° step

ACCURACY of QyScore markers and Visual Indexes

PD vs PSP			
	AUC	**Sensitivity**	**Specificity**
Manual MRPI	0.7698	0.7142857	0.888888
Automatic MRPI	0.9286	0.8571429	0.944444



Conclusions

- Automated markers quantified using QyScore® as well as the automatic MRPI equally performed as an expert neuroradiologist in distinguishing PD and PSP patients.

- The radiological evaluation is a time consuming process, prone to the clinician's expertise and to inter-observer variability.

- AI and machine learning will allow to obtain precise and reproducible measures.

Thank you for your attention

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