

Neural correlates of behavioral signs of consciousness: what can we learn from the MCS* ?

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Disclosure



Presenter has no relevant financial or non-financial interest to disclose.

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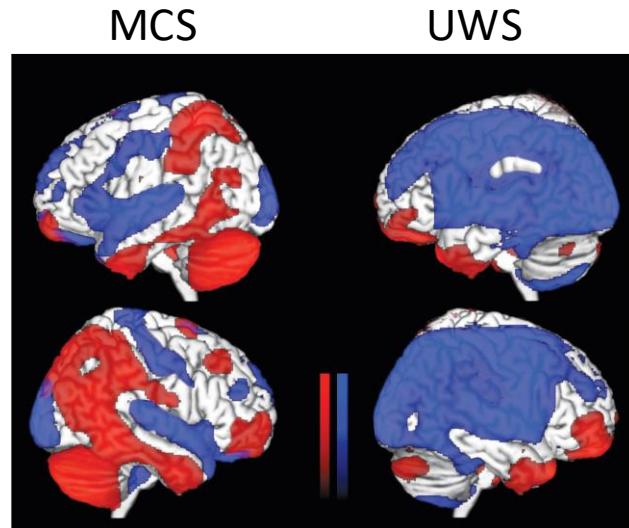
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Background



Brain metabolism preservation reported in some patients diagnosed as being unresponsive at the bedside
(Stender & Gosseries et al, 2014)



	Coma Recovery Scale-Revised results		
	UWS	MCS	Total
Clinical consensus diagnosis			
VS/UWS	33 (37%)	18 (20%)	51 (57%)
MCS	2 (2%)	36 (40%)	38 (43%)
Total	35 (39%)	54 (61%)	89 (100%)
¹⁸F-FDG PET			
VS/UWS	24 (21%)	5 (4%)	29 (26%)
MCS	12 (11%)	71 (63%)	83 (74%)
Total	36 (32%)	76 (68%)	112 (100%)
Mental imagery fMRI			
VS/UWS	25 (36%)	23 (33%)	48 (69%)
MCS	3 (4%)	19 (27%)	22 (31%)
Total	28 (40%)	42 (60%)	70 (100%)

UWS=unresponsive wakefulness syndrome. MCS=minimally conscious state.



Aim: to determine **brain regions** & connectivity needed to **demonstrate** behavioral **signs of consciousness**

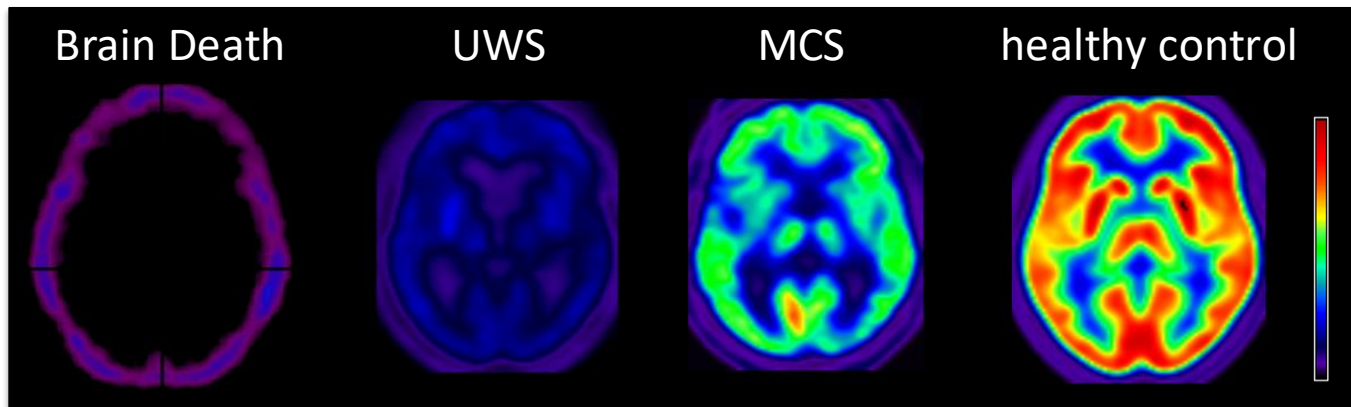
➔ regional brain metabolism and brain connectivity differences based on behavioural and PET-scan data :

- Unresponsive wakefulness syndrome = UWS (Laureys 2010)
- Minimally conscious state = MCS (Giacino et al, 2002)
- Clinically UWS with a partial brain metabolism preservation compatible with the diagnosis of MCS = MCS* (Gosseries et al, 2014; Stender et al, 2014)

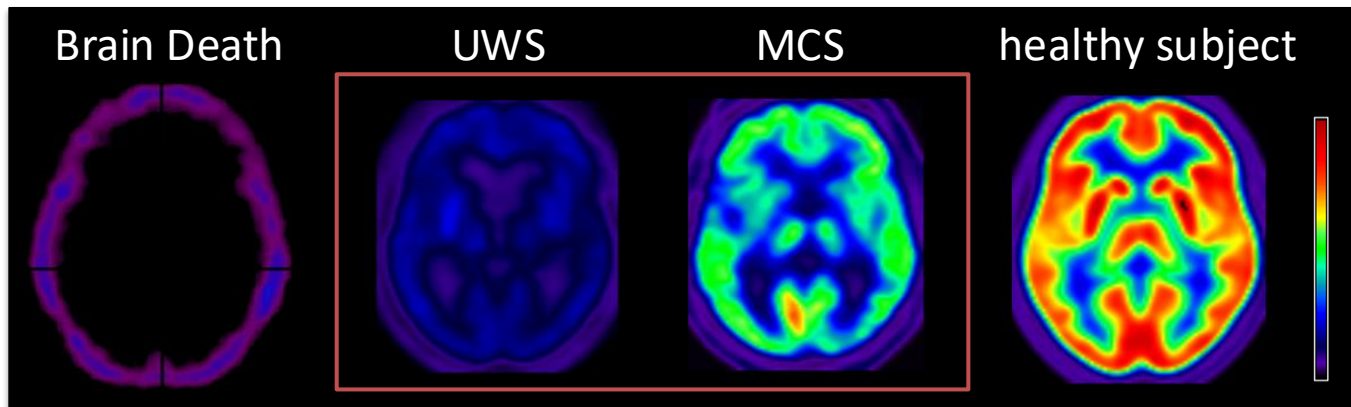


- ▶ Retrospective cross-sectional study - database of 184 patients
- ▶ Exclusion criteria:
 - Acute patients (<28 days post-onset)
 - Patients with unclear clinical diagnosis
 - < 16 years old
 - Repeated assessment (second assessment excluded)
 - Presence of large structural brain damage exceeding 25% of the whole brain volume not permitting reliable spatial normalization to the standardized stereotaxic brain template
 - Less than 5 CRS-R performed within 2 weeks

- ▶ ^{18}F FDG-PET-scan of patients in prolonged DOC – UWS & MCS
- ▶ Diagnosis of MCS* based on the FDG-PET relative preservation of global brain metabolism (SUV) as assessed by 3 experts (blind)



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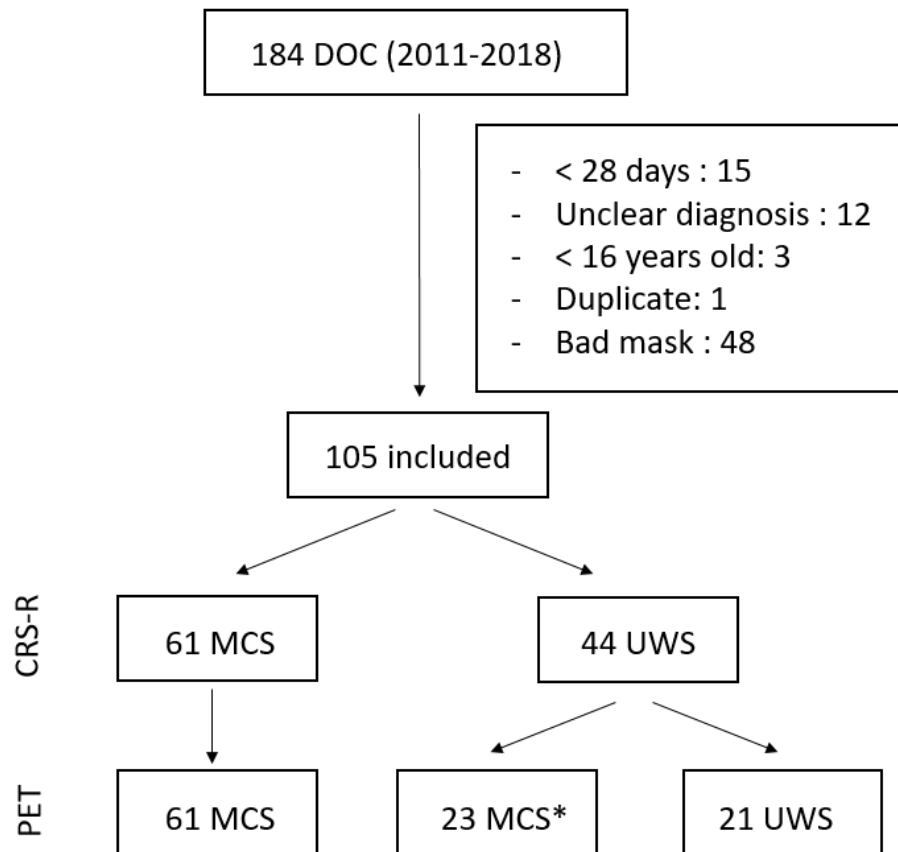


→ **MCS*** : 3 blinded examiners agreed by consensus on a relative preservation of brain metabolism compatible with the diagnosis of MCS, while the clinical diagnosis was UWS



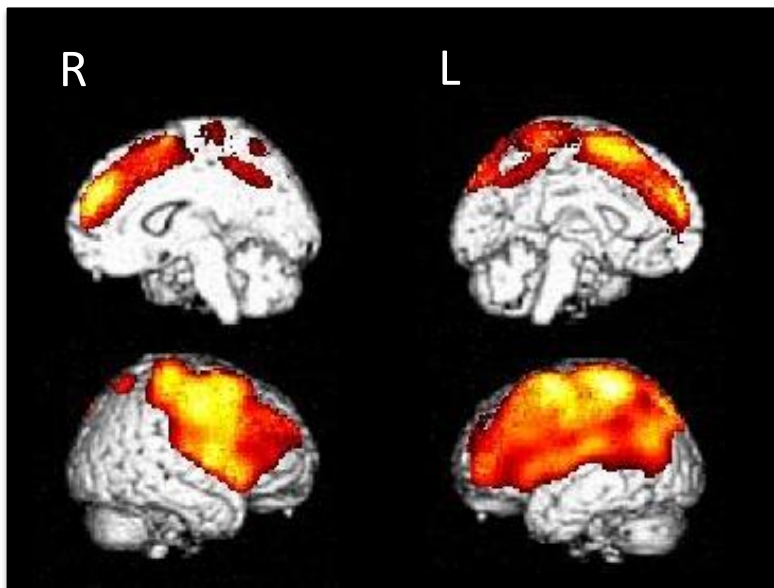
- Comparison of regional brain metabolism in UWS, MCS and MCS*
- Seed-based approach – which brain regions correlate with the areas found to be more preserved in MCS as compared to MCS*
 - ➔ necessary to **demonstrate** behavioral **signs of consciousness**

Results



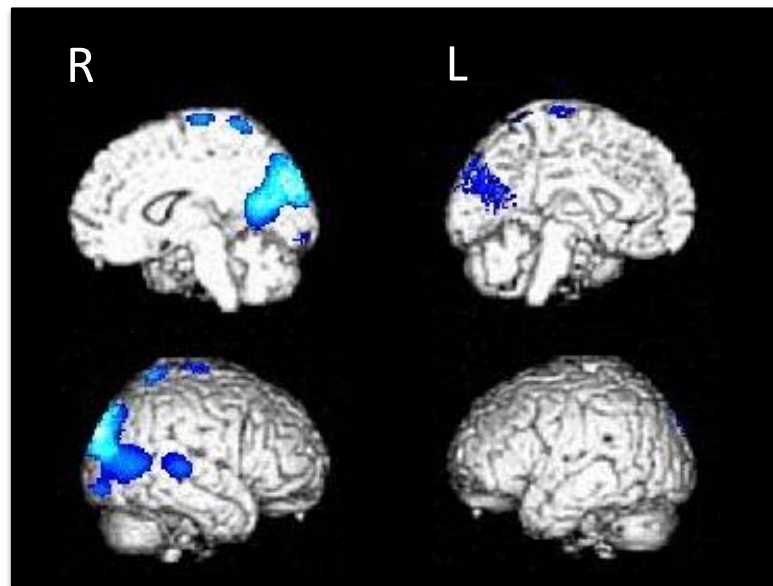
Results

MCS* > UWS



More preserved in MCS than UWS
internal and external awareness
networks

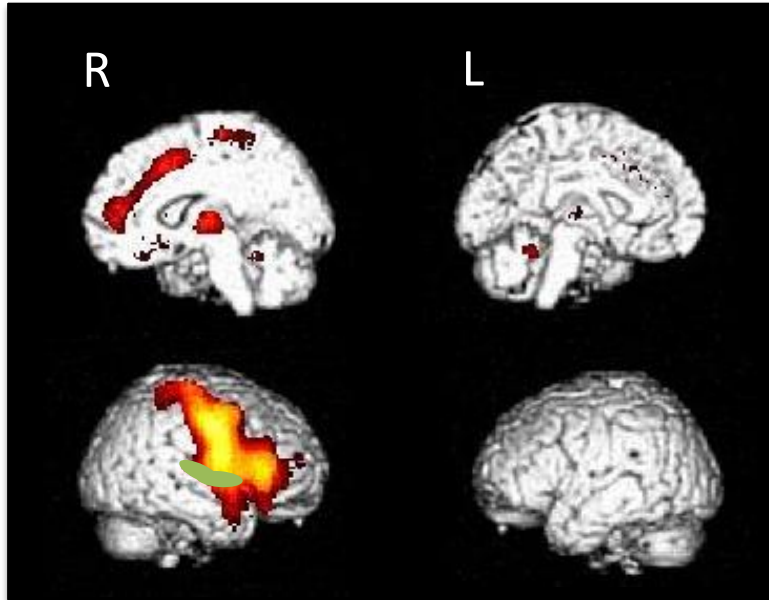
MCS* < MCS



Hypometabolic areas in MCS*
compared to MCS –
PPC/precuneus premotor – right
superior temporal gyrus (BA22)

Results

Functional connectivity in MCS > MCS* in right superior temporal gyrus (BA22)



Right superior temporal gyrus
more connected with: premotor
& SMA, sensory associative area,
DLPFC, right inferior frontal gyrus
(BA44/45 & 47) & thalami in MCS

➔ from comprehension to production



- ▶ **UWS $\neq$ MCS*** $\rightarrow$ higher regional brain metabolism in the **lateral and medial fronto-parietal networks** as compared to UWS patients with brain metabolism agreeing with the diagnosis
- ▶ **MCS* $\neq$ MCS** $\rightarrow$ higher connectivity between BA22 and sensory-motor areas, prefrontal cortex, BA44/45 and the thalami

Next: structural (VBM) & functional connectivity (hdEEG) differences



THANK YOU



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