A Multimodal Approach for Prognostication of Post-Anoxic Brain Injury: Beyond the Guidelines

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BACKGROUND

To adequately predict poor outcome in comatose survivors after cardiac arrest (CA), International Guidelines (ESICM/ERC) recommended the use of absent or extensor motor response at ≥ 72 hours from arrest in combination with either bilateral absence of pupillary light reflexes (PLR) or N20 waves of somatosensory evoked potentials (SSEPs). A multimodal monitoring (MMM) approach including other prognostic tools may be useful.

AIM OF THE STUDY

To compare the prognostic accuracy of a MMM approach with the Guidelines Recommendations.

METHODS

Retrospective analysis of adult (> 18 years) CA patients who underwent MMM from January 2016 to December 2017 and were included in a prospective institutional database.

Together with clinical variables and SSEPs, we collected, the presence of highly malignant EEG patterns (i.e. suppressed background or burst suppression), the absence of neurological pupillary index on the automated pupillometry (NPI=0) at 24 and 48-72 hours and the highest neuron-specific enolase (NSE) over the first 3 days.

3-month unfavorable outcome (UO) was defined for a Cerebral Performance Category ≥3.

RESULTS

A total of 84 patients were included, including 59 (70%) with UO. Characteristics of the study population are shown in Table 1. At 72 hours, UO was observed in 7/14 patients with absent PLR, in 7/7 with absent N20 and 10/10 with combined absent PLR and N20 (Table 2); 29/59 (50%) patients with UO were identified using this approach. Using the MMM approach, at 24 hours after CA UO was identified in 16/16 patients with NPI=0 and additional 16/17 patients with highly malignant EEG tracings. At 48-72 hours, UO was associated with absent N20 in 2/2 patients and with NSE > 50 µg/L in 9/9 patients. Unreactive EEG both at 24 and 48-72 hours was associated with UO in other 5/16 patients; a total of 48/59 (81%) patients with UO were identified using this MMM approach (Figure 1).

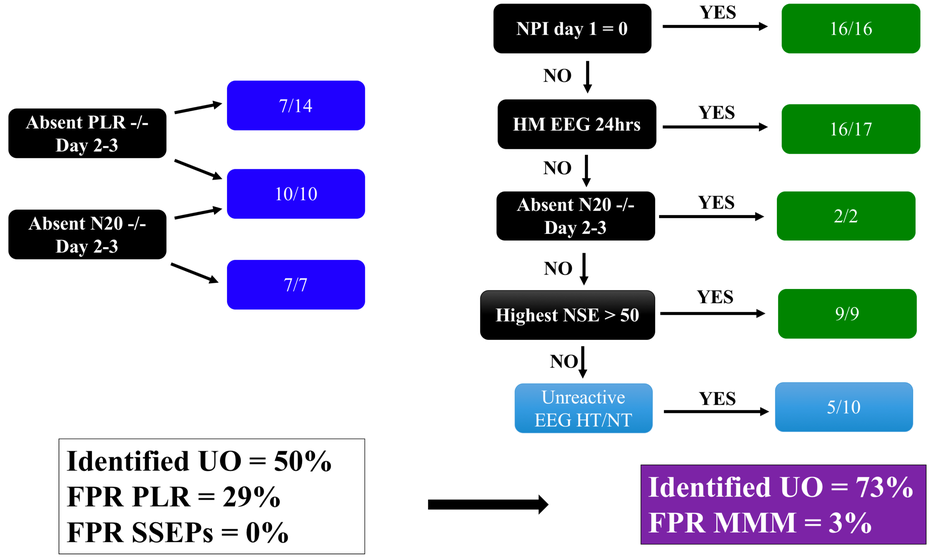
Table 1. Main characteristics of studied population

	All population (84)	Unfavourable Outcome (n=59)	Favorauble Outcome (n=24)	P value
DEMOGRAPHICS				
Age, years	67 (57-72)	68 (58-72)	60 (52-67)	0.03
Male gender, n (%)	63 (75)	41 (69)	22 (88)	NS
CARDIAC ARREST				
Witnessed, n (%)	70 (83)	46 (78)	24 (96)	0.05
Bystander CPR, n (%)	46 (55)	29 (49)	17 (68)	NS
Time to ROSC, min	25 (15-34)	25 (20-40)	15 (10-19)	<0.001
Out-of-hospital, n (%)	66 (79)	44 (75)	22 (88)	NS
Non-cardiac cause, n (%)	32 (38)	29 (49)	3 (12)	0.001
Non-shockable rhythm, n (%)	42 (50)	36 (61)	6 (24)	0.003
COMORBID DISEASES				
Heart Disease, n (%)	25 (30)	14 (24)	11 (44)	NS
COPD/Asthma, n (%)	11 (13)	8 (14)	3 (12)	NS
Liver Cirrhosis, n (%)	2 (2)	2 (3)	-	NS
Chronic Renal Failure, n (%)	5 (6)	3 (5)	2 (8)	NS
Diabetes, n (%)	18 (21)	13 (22)	5 (20)	NS
AFTER ADMISSION				
TTM, n (%)	84 (100)	25 (100)	59 (100)	NS
Vasopressors any time, n (%)	74 (88)	56 (95)	18 (72)	0.006
Inotropics any time, n (%)	43 (51)	33 (56)	10 (40)	NS
RRT any time, n (%)	12 (18)	9 (15)	1 (4)	NS
Lactate on Admission, mEq/L	7.5 (5.1-10.4)	8.5 (6.2-10.8)	4.5 (2.6-7.6)	<0.001
OUTCOME				
ICU Mortality, n (%)	55 (65)	55 (93)	-	<0.001

Table 2. Prognostic tools according to patients' outcome

	Unfavourable Outcome (n=59)
Poor Motor Response day 2-3	55 (93)
Absent PLR day 2-3	17 (29)
Bilaterally Absent N20	17 (29)
NPI=0 day 1	16 (27)
HM EEG 24 hours	25 (42)
Unreactive EEG HT/NT	37 (64)
Elevated NSE	35 (59)
	Favourable Outcome (n=24)
Poor Motor Response day 2-3	6 (24)
Absent PLR day 2-3	7 (28)
Bilaterally Absent N20	0 (0)
NPI=0 day 1	0 (0)
HM EEG 24 hours	1 (4)
Unreactive EEG HT/NT	5 (19)
Elevated NSE	0 (0)

Figure 1. Differences in prediction accuracy of UO between the ESICM/ERC guidelines vs. the MMM approach



CONCLUSIONS

These data suggest that a wider combination of prognostic tools may increase the accuracy of a MMM to identify patients with unfavorable after cardiac arrest.

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