Outcomes of Comatose Post-Cardiac Arrest Patients: a Descriptive Study

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INTRODUCTION

Approximately 80% of resuscitated cardiac arrest patients do not immediately regain consciousness. The longitudinal objective of our work is to develop a noninvasive tool to estimate likelihood of recovery of consciousness. The current objective is to examine outcomes of a cohort of 100 comatose patients.

METHODS

Chart review was performed of 100 patients at Boston Medical Center (BMC), 18-90 years old, who presented after cardiac arrest with at least 24 hours of EEG within 48 hours of arrest. Exclusion criteria included ophthalmoplegia, head trauma, or dementia. BMC's Clinical Data Warehouse extracted clinical data from their patient database. Outcomes were determined by available neurology department cardiac arrest consult notes. Chi-squared analysis (df=1) was performed to measure association between two outcomes (eyes opening to stimuli by the last exam and following commands by the last exam), some comorbidities (status epilepticus, heart failure, diabetes, polysubstance use), and demographics (such as race (white or black), sex, and age, respectively).

RESULTS

Pupillary Reflex
79.6% (74/93)* at first exam
85.0% (85/100) within 2 weeks
85.0% (85/100) at last exam

Corneal Reflex
45.7% (43/94)* at first exam
75.0% (75/100) within 2 weeks
76.0% (76/100) at last exam

Eyes Opening to Stimuli
10.6% (10/94)* at first exam
43.0% (43/100) within 2 weeks
45.0% (45/100) at last exam

Follows Commands
3.5% (3/86)* at first exam
21.0% (21/100) within 2 weeks
23.0% (23/100) at last exam

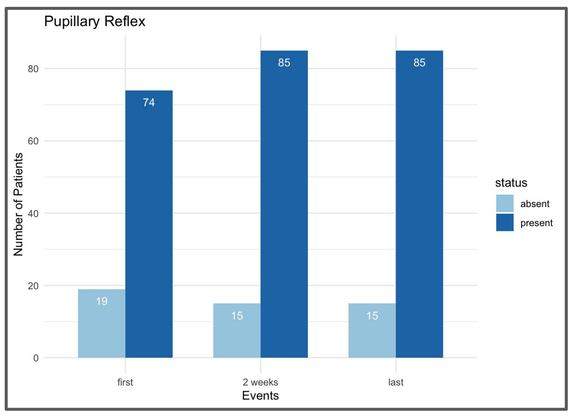

Figure 1: Number of patients with at least one pupillary reflex at their first exam, within 2 weeks of cardiac arrest, and at their last exam.

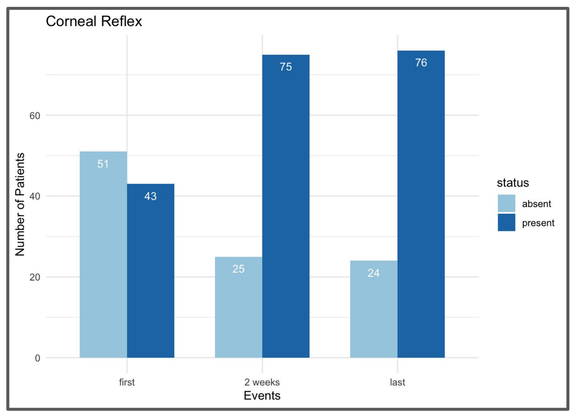

Figure 2: Number of patients with at least one corneal reflex at their first exam, within 2 weeks of cardiac arrest, and at their last exam.

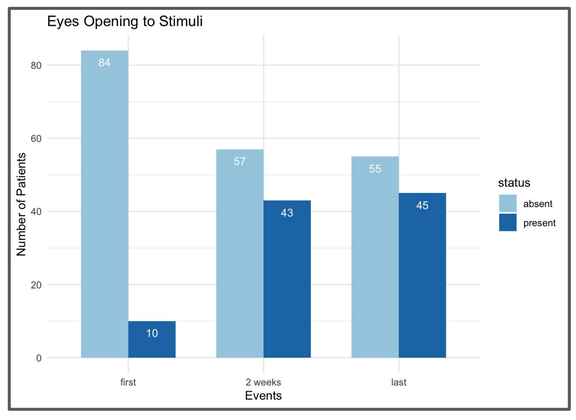

Figure 3: Number of patients with eyes opening to stimuli at their first exam, within 2 weeks of cardiac arrest, and at their last exam.

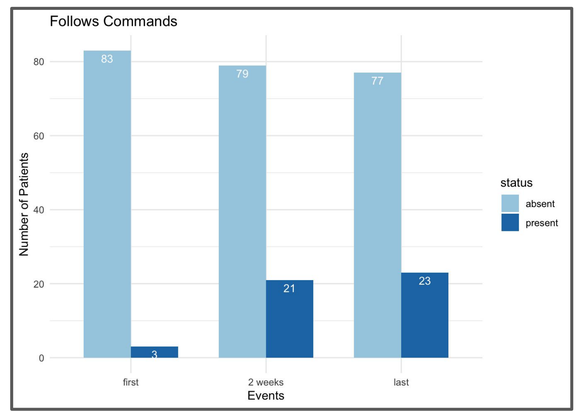

Figure 4: Number of patients following commands at their first exam, within 2 weeks of cardiac arrest, and at their last exam.

*patients excluded for missing data on first exam

Baseline Characteristics

Table 1. Baseline Characteristics of Cardiac Arrest Patients

Variable	Total (N=100)
Demographics	
Age (Mean ± Standard Deviation)	60.2 (±15.3)
Female	38 (38%)
Male	62 (62%)
Race	
Black	50 (50%)
White	24 (24%)
Asian	2 (2%)
Other*	24 (24%)
Ethnicity	
Hispanic	10 (10%)
Non-Hispanic	90 (90%)
Unknown	7 (7%)

*Patients who did not respond to a listed category or for whom data is unavailable

Table 2. Characteristic Associations With Outcomes by Last Exam

	Eyes Opening to Stimuli	Follows Commands
Status Epilepticus (n=27)	$\chi2 = 0.15$, p-value = 0.70	$\chi2 = 0.01$, p-value = 0.91
Heart Failure (n=40)	$\chi2 = 0.17$, p-value = 0.68	$\chi2 = 1.8$, p-value = 0.17
Diabetes (n=61)	$\chi2 = 3.36$, p-value = 0.07	$\chi2 = 0.25$, p-value = 0.62
Polysubstance Use (n=29)	$\chi2 < 0.01$, p-value = 0.98	$\chi2 = 0.03$, p-value = 0.86
Race (white) (n=24)	$\chi2 = 0.32$, p-value = 0.57	$\chi2 = 0.07$, p-value = 0.79
Race (black) (n=50)	$\chi2 = 1.01$, p-value = 0.31	$\chi2 = 0.06$, p-value = 0.81
Sex (male) (n=62)	$\chi2 < 0.01$, p-value = 0.97	$\chi2 = 0.73$, p-value = 0.39
Age Over 60 (n=43)	$\chi2 = 0.07$, p-value = 0.79	$\chi2 <= 0.18$, p-value = 0.67

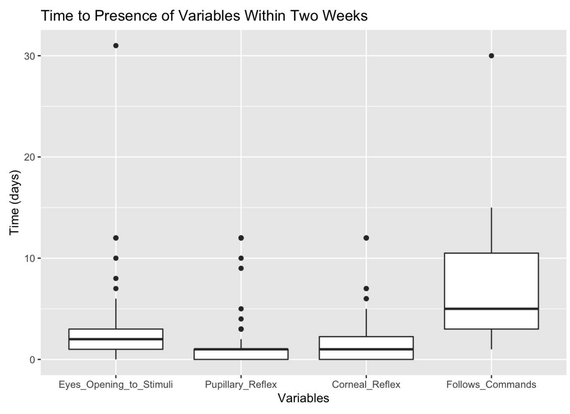

Figure 5: Time in days from cardiac arrest to positive eyes opening to stimuli, pupillary reflex, corneal reflex, and following commands. Median time to eye opening was 2 days (IQR=2 days). Median time to at least one pupillary reflex was 1 day (IQR=1 day). Median time to at least one corneal reflex was 1 day (IQR=2.25 days). Median time to following commands was 5 days (IQR=7.5 days).

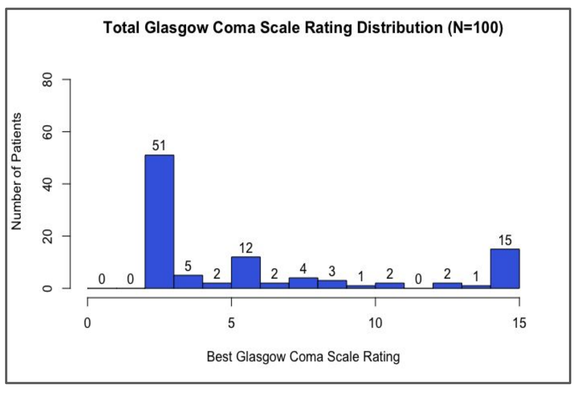

Figure 6: Best total GCS outcome distribution (n=100).

Figure 7: Flowchart of the Study

CONCLUSIONS

Almost 80% of our sample had at least one pupillary reflex on first exam, suggesting a potentially useful clinical variable for further study. None of our analyzed comorbidities or demographic factors had evidence of association with eyes opening to stimuli or following commands by last exam. Our sample is also racially diverse and balanced for sex and age, a helpful advantage when studying cardiac arrest. Understanding the demographic and clinical characteristics associated with recovery after cardiac arrest is important to inform prognostic models and guide future longitudinal studies.

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References
Wilson, J. A., Nordal, H. J. EEG in Connection with Coma, *Tidsskr Nor Laegeforen*; 2013, 1, 53-57. DOI: 10.4045/tidsskr.11.1432.
Edlow, B. L., Claassen, J., Schiff, N. D., Greer, D. M. Recovery From Disorders of Consciousness: Mechanisms, Prognosis and Emerging Therapies, *Nature Reviews Neurology*. 2021, 17, 135-156. DOI: https://doi.org/10.1038/s41582-020-00428-x
Claassen, J., Doyle, K. Detection of Brain Activation in Unresponsive Patients with Acute Brain Injury. *N Engl J Med*. 2019, 380, 2497-2505. DOI: 10.1056/NEJMoa1812757: