

Readmission and Post-ICU Epilepsy in a Pediatric Neurocritical Care Cohort

Matthew B Spear, MPH¹, Kristen Campbell, MS¹, Craig Press, MD, PhD^{1,2}, Christopher Ruzas, MD^{1,2}, Laura Pyle, PhD^{1,3}
Tellen D Bennett, MD^{1,2}, Peter M Mourani, MD^{1,2}, Aline B Maddux, MD, MSCS^{1,2}

¹University of Colorado School of Medicine, Aurora, Colorado ²Children's Hospital Colorado, Aurora, Colorado ³University of Colorado, Colorado School of Public Health, Aurora, Colorado

Introduction

- Neurocritical care encompasses high illness severity and a wide range of comorbidities.
- Pediatric Intensive Care Unit (PICU) patients with primary neurologic diagnoses often experience gaps in follow-up care.
- Rates of unplanned hospital readmission and development of new-onset epilepsy in these patients are poorly described.

Objective

To characterize the frequency of hospital readmission and development of epilepsy during the year after hospitalization for a primary neurologic critical illness.

Hypotheses

Aim 1. Seizures during the index hospitalization are associated with readmission.

Aim 2. Patients admitted for traumatic brain injury are more likely to develop post-ICU epilepsy compared to other neurocritical care diagnoses.

Materials and Methods

Tertiary care children's hospital (1/2013-12/2016)

Aim 1 (Readmission cohort): Inclusion: PICU patients mechanically ventilated for ≥ 3 days, primary neurologic diagnosis, post-discharge insurance data. Exclusion: tracheostomy prior to hospitalization, hospitalization non-survivors.

Aim 2 (Post-ICU epilepsy cohort): Aim 1 cohort with additional exclusions: prior diagnosis of epilepsy, < 9 months insurance data.

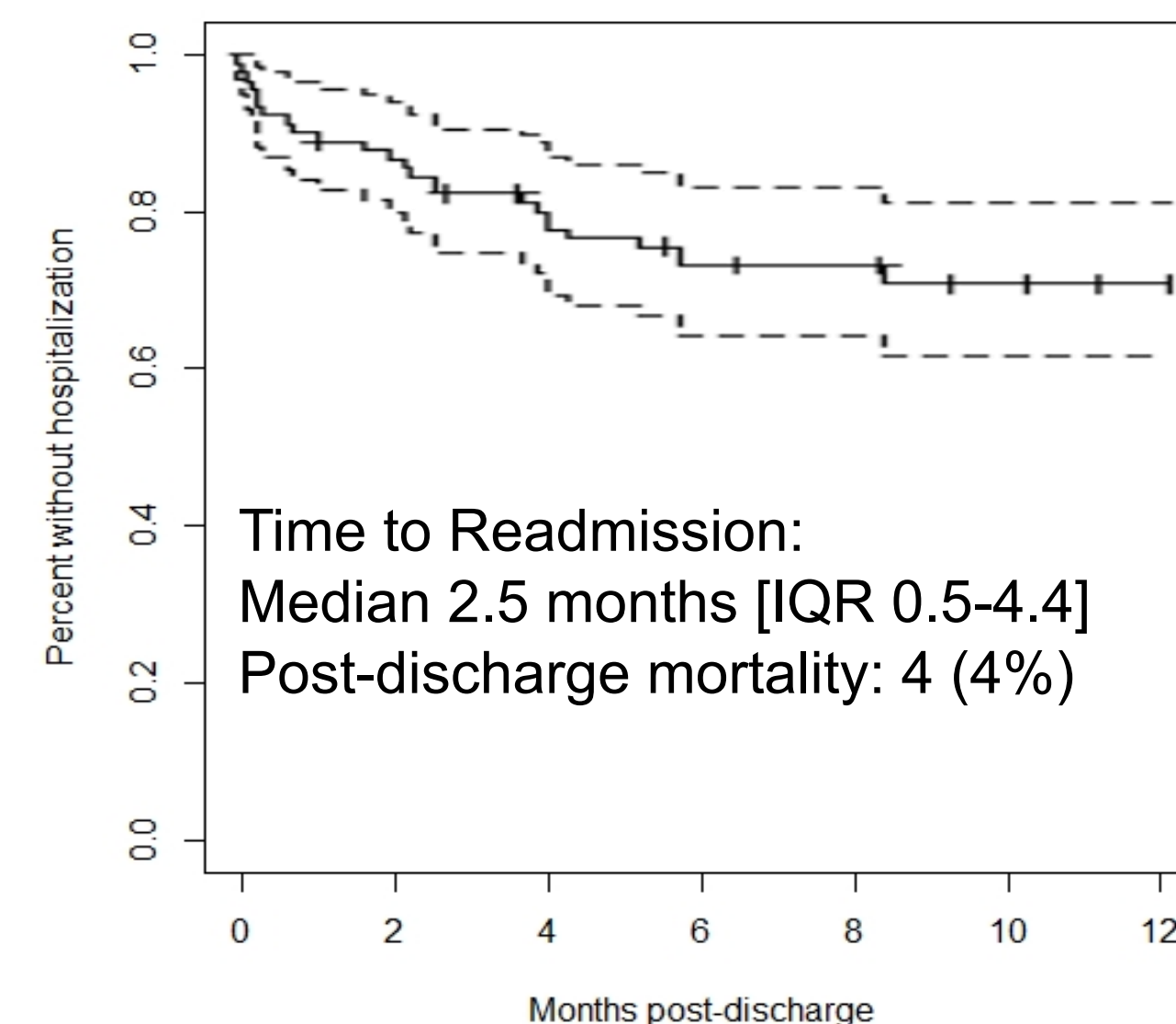
Univariate and multivariable time-to-event analyses using patient, admission, and hospitalization characteristics to evaluate for risks of readmission (Aim 1) and post-ICU epilepsy defined as maintenance anti-epileptic prescription filled months 6-12 after discharge (Aim 2).

Results

Study Cohort Characteristics	Readmission (n=101)	Post-ICU Epilepsy (n=84)
Age (months), median (IQR)	47 (4.9, 147)	32 (4.7, 143)
Male gender	74 (73%)	67 (79%)
PRISM III Score, median (IQR)	5 (2, 11)	5 (2, 11)
Days in PICU (IQR)	10.3 (8, 14)	10.6 (8, 14)
Days in Hospital (IQR)	41.3 (22, 61)	42.9 (23, 67)
Pediatric Medical Complexity Algorithm (PMCA) category		
- No chronic condition	49 (48%)	46 (54%)
- Complex chronic condition;	45 (44%)	34 (40%)
- Non-Complex Chronic Condition	8 (8%)	5 (6%)
Virtual Patient Systems (VPS) Primary diagnosis category		
- Trauma	58 (57%)	56 (66%)
- Seizures	15 (15%)	7 (8%)
- Infections & viral	4 (4%)	4 (5%)
- Hypoxic/Ischemic	17 (18%)	14 (18%)
- Brain	7 (7%)	3 (4%)
Seizure during index hospitalization	43 (42%)	33 (39%)

Aim 1. Unplanned Readmission

Figure 1. 26 (26%) Patients Had Unplanned Readmissions within 1 Year of PICU Discharge



Predictors of Time-to-Readmission in Univariable Analysis	Hazard Ratio (95% CI); P-value
Primary Dx: Seizures (vs all others)	3.03** (1.3, 7.0); p<0.01
Complex Chronic Condition (vs not)	5.04** (2.2, 11.5); p<0.001
PIM2 Risk of Mortality	1.02** (1, 1.04); p<0.05
Age at MV	0.96 (0.9, 1.02); p=0.17
Days in Hospital	1.7 (0.86, 3.37); p=0.12
Note: Primary Trauma diagnosis (including TBI) was significantly associated with decreased readmissions, HR: 0.22 (0.1, 0.5)	

Aim 2. Post-ICU Epilepsy

Almost 1/3 of Patients Develop Post-ICU Epilepsy:
Post-ICU Epilepsy Highly Associated with Seizures During Index Hospitalization

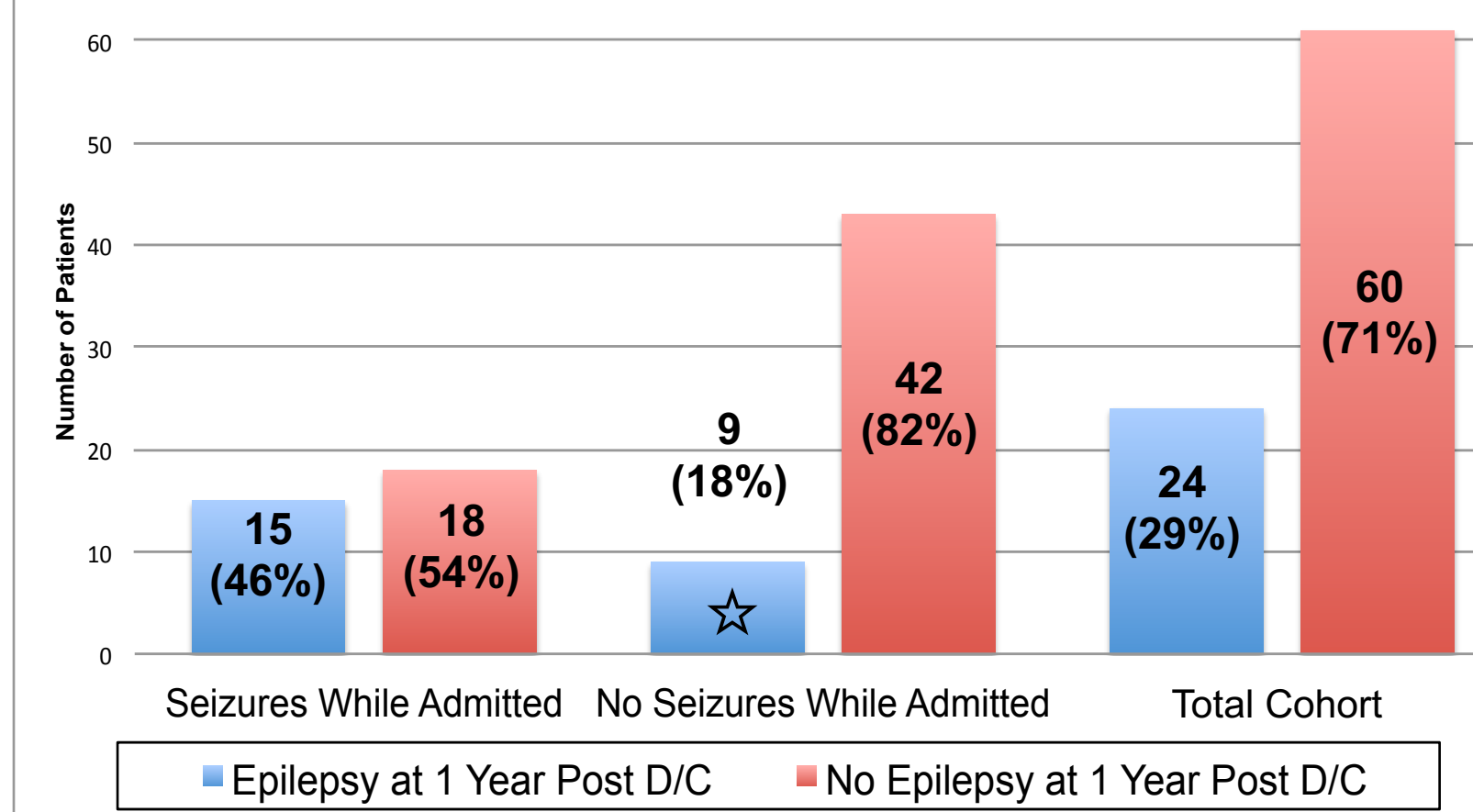


Figure 2: Patients who had seizures while admitted had four-fold increased odds of developing epilepsy, OR: 3.9 (95% CI: 1.5, 10.9; p<0.01). Neither pre-existing comorbidities nor primary diagnosis category increased the odds of post-ICU epilepsy.

☆Nine patients who did not have seizures during the index hospitalization developed epilepsy after discharge.

These nine patients are characterized by:

- Structural or hypoxic brain injuries without pre-existing chronic conditions;
- Older population (median age 143mos (12y) [IQR 63-162]);
- High illness severity (median PRISM III 11 [IQR 5-21]);
- Long durations of mechanical ventilation (median 9 days [IQR 7-12]);
- Long hospital lengths of stay (median 71 days [IQR 44-131]).

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Summary

- Unplanned readmissions were common and half occurred by 2.5 months after discharge.
- Patients admitted for seizures are at high risk of hospital readmission.
- 29% of patients without pre-existing seizures developed post-ICU epilepsy.
- A small but important proportion of patients develop post-ICU epilepsy despite a lack of seizures during their index hospitalization.

Limitations

- Cohort does not include less severely ill neurocritical care patients who required ≤ 3 days of mechanical ventilation.
- Patients without eligible insurance were excluded.
- Insurance claims for filled medication prescriptions were used to identify epilepsy.

Conclusions

- Unplanned, post-discharge health resource use was common.
- Unplanned readmissions were most common in patients with complex medical histories and patients with a primary seizure diagnosis.
- Only one severity indicator was predictive.
- Anticipatory guidance on post-ICU epilepsy should be considered in severely ill patients, even without seizures while inpatient.

Future Directions

- Within a larger cohort, characterize phenotypes of patients at risk for developing epilepsy.
- Confirm these findings in an ongoing prospective cohort study.
- Examine outcomes of patients who receive post-neurocritical care follow-up.