Risk of readmission for suicide attempt after epilepsy hospitalization

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ABSTRACT

Objective: The objective of this study was to examine if epilepsy admissions are associated with a higher readmission risk for suicide attempt, independent of psychiatric comorbidity, compared with index admissions for other medical causes.

Methods: The Nationwide Readmissions Database is a nationally representative dataset containing data from roughly 15 million hospital discharges. Analysis of International Classification of Disease Clinical Modification 9 (ICD-9-CM) codes in the year 2013 revealed 58,278 index admissions for epilepsy; this group was compared with admissions for stroke (N = 215,821) and common medical causes (N = 973,078). Ninety-day readmission rates for suicide attempts were calculated. Cox regression tested for associations between admission type and suicide attempt readmissions up to 1 year following index admission.

Results: There were 402/100,000 readmissions for suicide attempt within 90 days from index admission in the group with epilepsy; 43/100,000 in the stroke group; and between 37 and 89/100,000 in the medical group. Unadjusted hazard ratios (HR) for suicide readmissions within 1 year in the group with epilepsy compared with the stroke group were 9.61 (95% confidence interval (CI): 7.69–11.90, $p < 2.0 \times 10^{-16}$) and 5.02 compared with the medical group (95% CI: 4.40–5.73, $p < 2.0 \times 10^{-16}$). The HR for readmission in the group with epilepsy, after adjustment for sociodemographic and psychiatric variables, were elevated at 4.91 compared with the stroke group (95% CI: 3.83–6.27, $p < 2.0 \times 10^{-16}$), and 2.66 compared with the medical group (95% CI: 2.32–3.05, $p < 2.0 \times 10^{-16}$).

Conclusion: Independent of psychiatric comorbidities, epilepsy admissions may be independently associated with more than a threefold increased risk of hospital readmission for suicide in the year following index admission in comparison with patients recently hospitalized because of stroke or other common medical disorders.

1. Introduction

With almost one million people dying annually from suicide worldwide, identification of individuals at high risk of suicide is of enormous public health importance [1]. Patients with epilepsy face a particularly elevated risk of death by suicide, with an increased standardized mortality ranging from 2.6- to 5.0-fold [2] and 12% of all deaths in patients with epilepsy attributed to suicide [3]. Among patients with epilepsy, the incidence of depressive symptoms and suicidal ideation has been estimated to be significantly higher than in the general population or patients with other chronic neurologic diseases [4]. The prevalence of chronic suicidal ideation among patients with epilepsy has been estimated to be as high as 10% in some studies, with risk of completed suicide increased further in patients with epilepsy with depression [5]. It remains unknown whether the increased risk of suicidality associated with epilepsy is independent of the high prevalence of psychiatric comorbidities in patients with epilepsy.

Reducing hospital readmissions is an important focus of healthcare policymakers. Notably, patients with epilepsy—who already face a high financial burden with over $15 billion in annual nationwide costs in the US—are at an especially increased risk of readmission [6]. This can be in part attributed to the complexity of epilepsy medication

regimens, pharmacologic side effects, high prevalence of underlying cognitive dysfunction (e.g., impaired executive function and memory) and psychiatric comorbidities [7,8]. Despite the high prevalence of suicidality in patients with epilepsy, no studies to our knowledge have examined risk of readmission attributable to attempted suicide and/or suicidal ideation in patients with epilepsy. While much recent research has examined the neurobiology underlying the relationship between suicide and epilepsy [9,10], no research to date, to our knowledge, has utilized nationwide readmissions databases to estimate the risk of readmissions for attempted suicide in patients with epilepsy recently hospitalized for seizures. No research to our knowledge has assessed whether the increased risk of readmissions for suicide in patients with epilepsy exists independent of psychiatric comorbidities.

Because prevention and early identification of suicidal ideation may hold significant potential in decreasing 30-day readmissions in patients with epilepsy, understanding the relationship between psychiatric admission for suicide attempt and prior epilepsy admission is an important area of research. In this study, we sought to (a) calculate the readmission risk for attempted suicide in patients with an index admission for a primary diagnosis of epilepsy and (b) identify the psychiatric, socioeconomic, and medical variables contributing to risk of readmission for suicide in patients with epilepsy.

2. Methods

2.1. Data source and definitions

A nationally representative dataset from the Healthcare Cost and Utilization Project, the Nationwide Readmissions Database (NRD) contains data covering 1 year of admissions from 2013 from about 15 million hospital discharges; this represents almost half of all noninstitutionalized U.S. hospitalizations in 2013. Anonymized, verified patient linkage numbers were used to track readmissions during the same year within the same state. The NRD has data elements pertaining to patient demographics, hospital demographics (e.g., metropolitan area), patient disposition (dead, discharged alive to self-care, same day readmission, discharge to nursing facilities), International Classification of Disease Clinical Modification 9 (ICD-9-CM) diagnoses, and insurance characteristics.

2.2. Definition of index admissions

We selected all patients 18 years or older with a primary diagnosis of epilepsy in the NRD. Such patients were identified using ICD-9-CM codes. An epilepsy index admission was defined as an admission with a primary ICD-9-CM code of 345.xx. This case definition has been found to have a positive predictive value (PPV) of 98% for a diagnosis of epilepsy over a two-year period and has been used in multiple past studies to identify epilepsy cases [11]. The PPV when including the 780.3 ICD-9-CM code (seizure, convulsion) was lower at 83.5%, and consequently this code was not used. Comparison index admission groups included patients admitted for ischemic stroke (ICD-9-CM codes: 434. x, 436, 437.x, 346.6x, 433.x, 437.x) [12] and other common medical causes (chronic obstructive pulmonary disease (COPD), pneumonia (PNA), urinary tract infection (UTI)), identified and defined by appropriate ICD-9-CM codes [13,14] in the primary diagnosis position. Table e-1 includes the list of ICD-9-CM codes used to identify each medical index admission population. Prior ICD-9-CM validation studies for these conditions have been published.

2.3. Definition of covariates

Patient demographics and socioeconomic variables (age, sex, income of patient zip code, insurance status) were derived from ICD-9-CM codes. Baseline characteristics of each index admission group (epilepsy, stroke, and common medical causes) were calculated with regard to demographics, medical comorbidities, psychiatric comorbidities, and hospitalization characteristics (length of stay, all patients refined diagnosis related groups (APR-DRG) severity of the index admission [15], disposition at discharge, insurance status.)

Documented psychiatric comorbidity at index admission was defined, with ICD-9-CM codes shown in Table e-1 and described previously [16,17], in the categories of mood disorders, psychotic disorders, posttraumatic stress disorder (PTSD) and acute stress disorders, personality disorders, somatic symptom disorders (conversion, illness anxiety disorders), eating disorders, and adjustment disorders. Substance use and alcohol use disorder history was also defined by ICD-9-CM codes encompassing alcohol, opioids, sedative/hypnotic/anxiolytics, cocaine, cannabis, amphetamines, hallucinogens, and combinations of the aforementioned substances.

2.4. Outcomes

In our study, suicide attempts were identified using validated ICD-9-CM suicide and intentional self-injury codes 950–959 (see Table e-1). Prior studies have validated suicide attempts using ICD-9-CM suicide and intentional self-injury codes with a PPV and sensitivity of 86% and 65% respectively [18]. A prospective study followed patients with a history of ICD-9-CM suicide and intentional self-injury codes and found that such codes were predictive of higher future suicide death rates (HR = 10.45) [18,19]. While some studies have used poisoning and open wound injuries as part of intentional self-injury codes in predicting attempted suicides (296.20, 296.82, 300.4, 300.9, 311), such codes have been found to have PPVs in the 20–30% range [18,20] and thus were not used in this analysis.

With regard to completed suicides, the sensitivity for ICD-9-CM attempted suicide and self-injury codes has been found to have relatively low sensitivity (15–20% in some estimates) but high specificity (99–100%) in predicting suicides that were completed [21]. Interrater agreement for completed suicide attempt based on ICD-9-CM attempted suicide and self-injury codes remains relatively high, however, at 88–99%; negative and positive predictive values were also approximately 90% [21]. At present, validated ICD-9-CM case definitions of suicide ideation without attempt or plan have not been defined.

2.5. Statistical analyses

Descriptive statistics compared patients with epilepsy, stroke patients, and patients with common medical illness with regard to demographics, psychiatric history, and characteristics of index admission and hospitalization. Readmission rates were calculated as the number of readmissions due to suicide attempt within 30, 60, and 90 days of discharge from the index hospitalization. Nationwide Readmissions Database data do not differentiate between readmissions for suicide attempts and completed suicide. Rates were reported as per 100,000 index admissions. In calculating 30-day readmission rates, index hospitalizations in December were excluded; for 60-day rates, November and December index hospitalizations were excluded; for 90-day rates, October, November, and December index hospitalizations were excluded.

In addition to the calculation of 30-, 60-, and 90-day readmission rates, Kaplan–Meier curves were also created for the cumulative risk of readmission for suicide up to 1 year of follow-up, stratified by index admission type (epilepsy, stroke, common medical causes). The log-rank test was used to test for significance. Because only the month of admission and not the exact date is available in the NRD, the maximum observed follow-up period was calculated as the number of days from the midpoint of the month of index admission to December 31, 2013. Cox regression was subsequently used to examine the association between index admission type and readmission for suicide up to one year. Models were adjusted for demographic factors (age, sex, income quartile of patient's zip code), tobacco use history, history of substance use and alcohol use disorders defined by ICD-9-CM codes 303.xx and