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Behavioral health in young adults with epilepsy: Implications for transition of care

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ABSTRACT

Aim: Neurodevelopmental and behavioral health disorders commonly occur with epilepsy, yet risk for young adults is unknown. The aim of this study was to determine the distribution and risk characteristics of neurodevelopmental and behavior health comorbidities among young adults with epilepsy compared with those among young adults with migraine and healthy controls.
Method: A case-control study examining hospital admission, outpatient, and emergency department (ED) visits for young adults with an ICD-9-CM diagnosis of epilepsy, migraine, or lower extremity fracture (LEF) was conducted. The association of epilepsy, migraine, or LEF with comorbidities was evaluated with univariate and multivariate polytomous logistic regression.
Results: From 2000 to 2013, 29,139 young adults ages 19 to 25 years were seen in hospitals and EDs for epilepsy (5666), migraine (17,507), or LEF (5966). Young adults with epilepsy had higher proportions of behavioral health comorbidities (51.8%) compared with controls with migraine (37.6%) or LEF (21.6%). In young adults with epilepsy compared with migraine, the increased risk of having any behavioral health comorbidity was 76%, and neurodevelopmental comorbidity was 297%. After adjustment, young adults with epilepsy showed significantly higher odds of each behavioral health comorbidity compared with controls with migraine and LEF.
Interpretation: Young adults with epilepsy are particularly susceptible to behavioral health and neurodevelopmental disorders. Results are discussed within the context of transition to adult care.

1. Introduction

Up to 50% of persons with epilepsy have one or more neurodevelopmental (e.g., autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD)) or behavioral health (e.g., depression, anxiety) comorbidity [1], which are present prior to the onset and throughout the course of epilepsy [2–4]. Studies have examined epilepsy-related comorbidities in children, adolescents, and adults [5,6]; however, not many studies have specifically targeted the specific population of young adults (ages 19–25). Young adulthood or emerging adulthood (ages 19–25) is a time in which several socially important milestones exist/occur, including romantic relationships, independent living, attending college, and vocational exploration and initiation. Epilepsy and its comorbidities may present young adults with significant challenges to the achievement of such milestones. Longitudinal studies show that adults with epilepsy are less likely to be well educated and employed and have a romantic partner [7]. Further, comorbid behavioral health disorders in persons with epilepsy are associated with increased seizure frequency, healthcare utilization, and costs, as well as poorer health-related quality of life (QoL) [8,9]. Therefore, specific inquiry into the behavioral health functioning of young adults with epilepsy during this potentially vulnerable developmental period is warranted.

The purpose of this study was to determine the distribution and determinants of comorbid behavioral health and neurodevelopmental diagnoses among young adults with epilepsy compared with those with another neurological disorder — migraine [10–12] and with lower extremity fracture (LEF) as healthy controls. This study is

Abbreviations: LEF, lower extremity fracture; ASD, autism spectrum disorder; ADHD, attention-deficit/hyperactivity disorder; NINDS, National Institute of Neurological Disorders and Stroke; ILAE, International League against Epilepsy; QoL, quality of life; OR, odds ratio; ICD, International Classification of Diseases; DSM, Diagnostic and Statistical Manual of Mental Disorders.

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consistent with the benchmarks for epilepsy set forth by the National Institute of Neurological Disorders and Stroke (NINDS) [12]. We hypothesized that young adults with epilepsy have higher odds of neurodevelopmental and behavioral health comorbidities when compared with young adults with migraine, holding young adults with LEF as the reference for both groups and after adjusting for potential confounders. Results are discussed within the context of transition from pediatric to adult comprehensive epilepsy healthcare [13], a grossly understudied area in the care of persons with epilepsy [14].

2. Methods

This case–control study involved analysis of statewide surveillance data to assess the association of epilepsy, behavioral health, and neurodevelopmental comorbidities in young adults ages 19–25 years. The primary interest was in identifying the occurrence of these comorbidities in the case group of young adults with epilepsy and two control groups: a similar neurological group of young adults with migraine and a proxy for "healthy" control group of young adults with a single fracture of the tibia, fibula, or ankle (LEF). Cases and controls were identified from the same referent population based on the primary health conditions they have—epilepsy, migraine, and LEF—defined by time and space without invoking matching. The group with LEF was presumed to represent young adults in the general population and was considered as the common control group for both epilepsy and migraine. Methods for the larger South Carolina surveillance study of epilepsy comorbidities have been previously published [5,6].

2.1. Study setting and population

All hospital, emergency department (ED), or hospital-based outpatient (OPD) visits for young adults ages 19–25 with a diagnosis of epilepsy, migraine, or LEF from January 1, 2000 to December 31, 2013 were identified. Analyses were limited to the index diagnosis of epilepsy (case group 1; ICD-9-CM 345.x), migraine (control 1; ICD-9-CM 346.x), or LEF (control 2; ICD-9-CM 823.x and 824.x). Patients with epilepsy and migraine were included only in the group with epilepsy. This study protocol was reviewed and exempted by our institution's Review Board. The group with LEF was intended to represent otherwise healthy young adults in the general population, and those with LEF with multiple injuries to other body regions were excluded.

2.2. Comorbid diagnoses

Comorbid somatic, neurodevelopmental, and behavioral health diagnoses considered in this analysis were first identified according to the International League against Epilepsy (ILAE) Epidemiology Commission report [15] and reported in our earlier studies [5,6]. All diagnosis fields were searched for these conditions and a variable constructed for each condition. Neurodevelopmental and behavioral health conditions were dichotomized into 'yes' or 'no'. Somatic comorbidities were included as potential confounders in the regression models. The number of somatic comorbidities was categorized into four groups (None, 1 to 2, 3 to 5, and 6 or more). Those somatic diagnoses with very few occurrences (<4 cases) in the SC healthcare data (e.g., cystocercosis, onchocerciasis) were dropped. Appendix A contains the neurodevelopmental, behavioral health, and somatic comorbid diagnoses with corresponding ICD-9-CM codes. Previous abstraction and validation of ICD-9-CM codes with discharge diagnosis narratives coded by certified health information specialists showed accurate ICD-9-CM coding to the 5th digit 85.2% of the time and nearly uniform accuracy to the 3rd digit of the codes [16].

Race–ethnicity was categorized into non-Hispanic white, non-Hispanic black, Hispanic, and other. Mortality information on individuals was obtained through 2013. Payer status was classified as Uninsured (self-pay, other), Medicare, Medicaid (includes indigent care), and Commercial (private, Tricare, Champus, worker's comp). The number of visits over the study period ranged from a single visit to hundreds. The average number of visits per year was calculated based on the number of years from the first visit to either death or the end of the data period in 2013.

2.3. Statistical analysis

Data analyses were conducted using the SAS software package [17]. Descriptive statistics were generated for the case and both control groups. For continuous variables, differences in means were tested with ANOVA and pairwise comparison of means further tested using the Tukey adjustment. For categorical variables, differences in distribution were tested with Chi-square tests of independence and by assessing differences in proportions under the assumption of independence of the proportions under normal approximation. The association of epilepsy, migraine, or LEF with any behavioral health or neurodevelopmental comorbidity, other somatic conditions, mortality, number of medical visits, and demographic characteristics was evaluated with univariate and multivariate polytomous logistic regressions using generalized logit model [18,19]. Polytomous logistic regression gives simultaneous odds ratio (OR) estimates with 95% CI for epilepsy vs. LEF and migraine vs. LEF in a single model. For both epilepsy and migraine, 95% CIs that do not include 1 indicate a significant difference from the group with LEF across patient groups with epilepsy and migraine.

All covariates were entered into the model simultaneously. Variables with bivariate association, p-values ≤0.10, were included in the multivariable model. The adjusted ORs and 95% CIs are reported.

3. Results

From 2000 to 2013, 29,139 young adults ages 19 to 25 were seen in SC hospitals and EDs for epilepsy (5666), migraine (17,507), or LEF (5966). Table 1 describes demographic and clinical characteristics for the three groups. The distributions among the three groups were significantly different with few exceptions. Young adults with epilepsy had higher rates of behavioral health comorbidities (51.8%) compared with controls with migraine (37.6%) or LEF (21.6%; all $p < .001$). Similarly, controls with migraine had higher proportions of behavioral health comorbidities than controls with LEF. Young adults with epilepsy had a higher proportion of neurodevelopmental comorbidities (14.3%) than controls with either migraine (3.7%) or LEF (3.3%) (all $p < .001$). The distribution of gender was comparable in young adults with epilepsy while 81.4% of controls with migraine were female and 62.5% of controls with LEF were male. All three groups had comparable proportions of individuals identifying with a particular race/ethnicity. Young adults with epilepsy were more likely to have died during the study period. Young adults with epilepsy or migraine had higher average medical visits per year than controls with LEF, and adults with migraine averaged one more visit per year than young adults with epilepsy. Controls with migraine had similar counts of somatic comorbidities compared with young adults with epilepsy; young adults with epilepsy and controls with migraine had more somatic comorbidities than controls with LEF.

Table 2 reveals the breakdown of the specific behavioral health and neurodevelopmental comorbidities by group. The proportion of young adults with epilepsy who had a neurodevelopmental comorbidity was approximately four-fold higher than cases with migraine or controls with LEF. In all three comparative groups, the proportion of individuals with a neurodevelopmental disorder was higher in those with any behavioral health comorbidity than in the total group (all $p < .001$). When adjusting for multiple comparisons, the prevalence of all behavioral health and neurodevelopmental comorbidities was generally higher in young adults with epilepsy compared with that in controls with migraine and LEF (all $p < .001$). With the exception of alcohol misuse, controls with migraine