Injuries in Adolescents with Childhood-Onset Epilepsy Compared with Sibling Controls

Christine B. Baca, MD, MSHS[1,2], Barbara G. Vickrey, MD, MPH[1,2], Stefanie D. Vassar, MS[1,2], Aaron Cook, BA, MPH[1], and Anne T. Berg, PhD[3,4]

Objective To compare the occurrence of injuries in adolescents with childhood-onset epilepsy and matched sibling controls.

Study design Retrospective case-control lifetime injury assessments were obtained from a community-based cohort of adolescents with childhood-onset epilepsy diagnosed 9 years earlier and their siblings. The children with epilepsy (n = 501; mean age, 15.3 years) included those with complicated (abnormal neurologic examination or IQ <80; n = 133) and uncomplicated (normal neurologic examination and IQ ≥80; n = 368) epilepsy. Children with uncomplicated epilepsy were matched to sibling controls (n = 210 pairs). The children reported whether or not they had ever (before and after epilepsy diagnosis) experienced injuries "serious enough to require medical attention" and if so, the type of treatment required.

Results Almost one-half (49.1%) of the children with epilepsy experienced injury, of whom 8.9% required surgery/hospitalization and 17.1% had injury related to a seizure. Fewer children with uncomplicated epilepsy had seizure-related injuries versus those with complicated epilepsy (13.6% vs 27.4%; $P \leq .01$). The proportion of children with epilepsy with any injury by type (not mutually exclusive) were: 25.2% with fractures (n = 126); 24.4% with head injuries (n = 122); 10.2% with other injuries (n = 51); 8.4% with dental injuries (n = 42); and 8% with burns/scalds (n = 40). A similar proportion of children with uncomplicated epilepsy experienced any injury (overall and by type) compared to matched sibling controls, with the exception that more children with uncomplicated epilepsy had head injuries (30.0% vs 19.5%; $P < .02$).

Conclusion With the exception of head injuries, we found no evidence of an increased risk of injury in a representative cohort of children with epilepsy compared with matched sibling controls. This finding may reflect the fact that the sample was not biased to more severe cases, or that safety precautions to prevent injury were widely used. *(J Pediatr 2013;163:1684-91)*.

Persons with epilepsy are commonly thought to be at increased risk for accidental injury compared with the general population, resulting in significant morbidity, mortality, and cost.[1,2] The assessment of injury risk in persons with epilepsy depends largely on the type of study population, how injuries are defined and assessed, whether or not injuries are seizure-related, and the presence or absence of a control sample.[3] Although several previous studies have examined injuries in children with epilepsy,[4-19] the majority focused on clinic or hospital-based, and often refractory, samples.[4,5,8,9,17,19] Even though numerous studies of injuries in children with epilepsy (or including children with epilepsy) have included population-based samples,[6,10,11,13-16,18] a limited number of these included control samples, some of which only focused on a single injury or epilepsy type, and most of these studies found higher rates of injury in children with epilepsy compared with controls.[10,13,15,16,18]

As noted in a recent report from the Institute of Medicine, "scant data exist on injury in children with epilepsy."[20] Injury incidence in a representative cohort of children with epilepsy, including those with uncomplicated epilepsy (defined as typical cognition and normal neurologic examination), at long-term follow-up is unknown. The goals of the present study were to assess histories of cumulative injuries in a community-based cohort of adolescents with childhood-onset epilepsy diagnosed 9 years earlier and followed prospectively, and to compare these reports with matched sibling controls. We also sought to examine the proportion of cases with seizure-related injuries and to assess epilepsy-related risk factors for injury. We hypothesized a higher proportion of children with complicated epilepsy would report injuries compared with children with uncomplicated epilepsy.

Methods

The Connecticut Study of Epilepsy is a community-based cohort study of 613 children (aged 1 month through 15 years) with newly diagnosed epilepsy

AED Antiepileptic drug

From the [1]Department of Neurology, University of California Los Angeles; [2]Department of Neurology, VA Greater Los Angeles Health Care System, Los Angeles, CA; [3]Epilepsy Center, Ann and Robert H. Lurie Children's Hospital of Chicago; and [4]Department of Pediatrics, Northwestern Memorial Feinberg School of Medicine, Chicago, IL

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Conflict of interest information is available at www.jpeds.com (**Appendix**).

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(defined as ≥2 unprovoked seizures) enrolled by participating pediatric neurologists between 1993 and 1997 and followed prospectively. The characteristics of this cohort are comparable to those of a Canadian study that is generally accepted as population-based with respect to age of onset, sex, and proportion of participants with certain well-recognized forms of epilepsy, intellectual disability, and mortality.[21,22] Details of study methodology, recruitment, and follow-up have been published previously.[23,24]

At 9 years after the diagnosis of epilepsy, a time interval deemed sufficient to evaluate long-term outcomes, 501 of the 613 study subjects (82%) participated in a reassessment protocol that included a retrospective evaluation of cumulative injuries occurring at any time since birth ("lifetime" injuries) in children with epilepsy (cases) and their sibling controls (n = 284; within 3 years of age of the child with epilepsy, with typical cognition and without significant neurologic disability) (**Figure 1**; available at www.jpeds.com). The children with epilepsy were subdivided into those with uncomplicated epilepsy (n = 368) and those with complicated epilepsy (n = 133). The children with uncomplicated epilepsy had a normal neurologic examination and "typical cognition" (consistent with IQ ≥80), whereas the children with complicated epilepsy had an abnormal neurologic examination or "impaired cognition" (consistent with IQ <80). An abnormal neurologic examination (motor, sensory, coordination, or gait abnormalities) was based on neurologic medical chart review of the clinical examination and with consensus from 3 reviewing pediatric neurologists. Of the 368 children with uncomplicated epilepsy, 210 had a matched sibling control.

Institutional Review Board approval was obtained at all sites. Written informed consent was obtained from the parents and written assent was obtained from children aged <18 years at the time of enrollment and the 9-year reassessment. Written consent was obtained from case and sibling control participants aged ≥18 years at the 9-year reassessment.

At the time of enrollment and the 9-year reassessment, clinical and demographic data for the children were obtained through structured parent interviews by trained research associates. Interim reviews of neurologic medical records and quarterly follow-up telephone interviews with parents were used to track seizure occurrence and treatment. Epilepsy syndromes and seizure types for each case were independently classified and verified by 3 pediatric neurologists using data from parent interviews, neurologic medical chart review, neuroimaging, and electroencephalography. Epilepsy syndromes were categorized according to recent recommendations.[25] Cognitive status was assessed using information from neurologic medical records, parent interviews, school records, and standardized neuropsychological testing using the Wechsler Intelligence Scale for Children.[23] Children with epilepsy were classified as having either "typical" cognition (consistent with IQ ≥80) or "impaired" cognition (consistent with IQ <80). At the 9-year reassessment, seizure remission was defined as being seizure-free for ≥5 years based on the date of the last recorded seizure. Medication status was characterized as currently taking 1 or more antiepileptic drugs (AEDs) vs no AEDs.

Injury Assessment

At the 9-year reassessment, lifetime injuries were assessed among cases and sibling controls. Each child (or parent-proxy) answered the following question: "Have you ever suffered any of the following injuries seriously enough to require medical attention?": (1) a burn or a scald (simple dressing, skin grafting); (2) a head injury (stitches, skull fracture, operation); (3) a dental injury (loss of teeth, fractured jaw, surgery); (4) any other fracture (which bone); and (5) other injury (specify). For each injury type, the children with epilepsy were asked, "Did you suffer this injury as a result of a seizure?," and all participants were asked, "Did the injury require hospitalization?" The interviewer recorded free text responses describing the injuries and the type of medical treatment required.

Free text responses were reviewed and categorized into injury types and subtypes and treatment categories. Injury types and subtypes were classified as "burns/scalds," including any mention of a burn or scald; "head injury," including concussion, laceration of face or scalp, falling or hitting head, skull fracture, and other unspecified head injury; "dental injury," including tooth loss, chipped teeth, fractured jaw, and other unspecified tooth injury; "fracture," including large bone (leg/arm), medium bone (wrist/hand/ankle/foot), small bone (finger/toe), or other (nose, growth plate, or unspecified) fracture; and "other," including laceration or abrasion in an area other than the face or head, dislocation, sprain or strain, and other injury (eg, bite, bruise, eye or unspecified injury) (**Table I**; available at www.jpeds.com). Some initial injury type responses were reclassified using information from free text responses, to most appropriately reflect accurate injury types and subtypes.

Medical treatment was classified as nonsurgical procedure, surgery, hospitalization, other care (outpatient visit, emergency room visit, physical therapy, medication, or medical visit not specified), unspecified (no explicit characterization or description of treatment), or no treatment (explicit statement that no treatment was required) (**Table II**; available at www.jpeds.com). Two independent coders completed the coding of injury types and subtypes and treatment categories, with high interrater agreement seen for 10% of the sample (agreement, 87.0%-100%).

Statistical Analyses

Sociodemographic and clinical characteristics, along with the proportion of children with injuries (by type and overall) and medical treatment types, were compared between the children with epilepsy and sibling controls and between different subgroups of children with epilepsy using appropriate bivariate statistics (*t* test, χ^2 test, or Fisher exact test [2-sided] or the McNemar test for paired comparisons). The proportions of children with given injury types and subtypes were calculated for all children with epilepsy, including those with uncomplicated and complicated epilepsy, as well as for the