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Research paper

The risk of injury in adults with attention-deficit hyperactivity disorder: A nationwide, matched-cohort, population-based study in Taiwan



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ABSTRACT

Background: Few studies have investigated the risk of injuries associated with adults with attention-deficit hyperactivity disorder (ADHD), even though several studies have suggested a higher risk of injury in children and adolescents with ADHD.

Aims: To investigate the risk of injury in adults with ADHD.

Methods and procedures: We included 665 adults with ADHD from January 1, to December 31, 2000, and 1995 sex-, age- and index day-matched controls without ADHD from the Longitudinal Health Insurance Database (LHID) subset of the National Health Insurance Research Database in Taiwan. The Cox proportional hazard models were used to analyze the associations between the relevant demographics, and the psychiatric comorbidities and the risk of injury.

Outcomes and results: The patients with ADHD had a 143% increased risk of overall injuries than the controls after considering all the confounding factors. In addition, the use of methylphenidate was associated with a 22.6% decrease in the risk of injuries in the patients with ADHD.

Conclusions and implications: Our findings strongly support that adults with ADHD are at an increased risk of injury, and imply that methylphenidate therapy may attenuate this risk.

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What this paper adds?

This nationwide, matched-cohort, population-based study in Taiwan showed that adults with attention-deficit hyperactivity disorder (ADHD) are associated with increased the risk of injuries, and methylphenidate therapy may attenuate this risk.

1. Introduction

Attention-deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder with a prevalence of 1.4–3.0%. The onset usually occurs in childhood, and some symptoms and signs such as inattention, hyperactivity and impulsivity can persist to adulthood (Thapar & Cooper, 2016). A diagnosis of ADHD is associated with poor academic and educational outcomes (Loe & Feldman, 2007), and in adulthood, some patients with ADHD might suffer from one or more additional psychiatric disorders such as mood and anxiety disorders, conduct disorders, personality disorders, or substance use disorders (Cumyn, French, & Hechtman, 2009; Klein et al., 2012; Sobanski, 2006). Therefore, the identification, treatment and management of ADHD and the consequent psychosocial risks are important in both children and adults.

Adults with ADHD are associated with high morbidity and health costs (Groom, van Loon, Daley, Chapman, & Hollis, 2015). Furthermore, adults with ADHD are associated with a higher mortality from accidents, and these causes of death are preventable (Dalsgaard, Ostergaard, Leckman, Mortensen, & Pedersen, 2015; London & Landes, 2016). Therefore, injuries are an important issue in children and adolescents with ADHD, and the risk of injury in this population has been reported to be higher than in those without ADHD (Kang, Lin, & Chung, 2013; Merrill, Lyon, Baker, & Gren, 2009; Tai, Gau, & Gau, 2013). In addition, it has been reported that children and adolescents with ADHD are associated with an increased risk of bone fractures (Chou, Lin, Sung, & Kao, 2014), hospitalizations due to injury (Silva, Colvin, Hagemann, Stanley, & Bower, 2014), accidental dental injuries (Mota-Veloso et al., 2016), unintentional injuries (Lam, 2002; Lam, Yang, Zheng, Ruan, & Lei, 2006), and more trauma-related emergency department visits (Ertan, Ozcan, & Pepele, 2012). Children and adolescents with ADHD are also associated with a higher risk of traumatic brain injury (TBI), more neuropsychological functional deficits and poorer recovery from the injury (Bonfield, Lam, Lin, & Greene, 2013; Van Patten, Keith, Bertolin, & Wright, 2016).

Even though patients with ADHD still have symptoms in adulthood, few studies have investigated the risk of injuries in these adult patients with ADHD, and the published studies were limited to traumatic brain injuries and concussion (Alosco, Fedor, & Gunstad, 2014; Ilie et al., 2015; Nelson et al., 2016). Furthermore, the effects of medications such as methylphenidate and atomoxetine had been reported to attenuate the risk of injuries in children with ADHD (Dalsgaard, Leckman, Mortensen, Nielsen, & Simonsen, 2015; Mikolajczyk et al., 2015), however no studies have, as yet, reported on as to whether methylphenidate and atomoxetine can reduce the risk of injuries in adults with ADHD. Therefore, we conducted this study to investigate the association between adults with ADHD and the risk of all types of injuries, and the role of methylphenidate and atomoxetine treatment in reducing this risk using the National Health Insurance Database in Taiwan.

2. Methods

2.1. Data source

In this study, we used outpatient and hospitalization data from the Longitudinal Health Insurance Database (LHID), a subset of the NHIRD, to investigate the association between ADHD and injuries over a 10-year period (2000–2010) in Taiwan.

The National Health Insurance (NHI) Program was launched in Taiwan in 1995, and as of June 2009 it included contracts with 97% of all medical providers in Taiwan with approximately 23 million beneficiaries, or more than 99% of the entire population in Taiwan (Ho Chan, 2010). The National Health Insurance Research Database (NHIRD) uses the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes to record diagnoses (Chinese Hospital Association, 2000), and all diagnoses of ADHD are made by board-certified specialists such as psychiatrists, pediatricians, neurologists, or physiatrists specializing in child and adolescent development. The NHI Administration randomly reviews the records of 1 in 100 ambulatory care visits, and 1 in 20 inpatient claims, to verify the accuracy of the diagnoses (National Health Insurance Administration, 2013), and several studies have demonstrated the accuracy and validity of the diagnoses in the NHIRD (Cheng, Kao, Lin, Lee, & Lai, 2011; Chou, Lin, Lin, Sung, & Kao, 2013; Liang et al., 2011).

2.2. Study design and sampled participants

2.2.1. Study design

This study was of a retrospective matched-cohort design.

2.2.2. Sample

Patients with ADHD were selected from 1 January 1, to December 31, 2000, according to ICD-9-CM code 314. Each enrolled patient was required to have made at least three outpatient visits within this one year period for ADHD according to this ICD-9-CM code. The patients diagnosed with injuries before 2000 or before the first visit for ADHD, and the patients with diagnoses codes for substance dependence (ICD-9-CM 304) or substance abuse (ICD-9-CM 305) were excluded. All patients aged < 18 years were also excluded. A total of 2660 patients were enrolled, including 665 subjects with ADHD and 1995 age-, sex-, index year-, comorbidity-,

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