

Persistent symptoms in mild pediatric traumatic brain injury

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Akella Chendrasekhar^{1,2}

¹Department of Surgery, Richmond University Medical Center, Staten Island, NY, USA; ²Department of Surgery, SUNY Downstate Medical Center, Brooklyn, NY, USA

Background: Traumatic brain injury (TBI) is the leading cause of morbidity and mortality for children in the US. The objective was to examine the epidemiology of self-reported neurologic and neuro-psychiatric symptoms in pediatric patients with mild TBI within 14 months post-injury.

Methods: A telephone based survey was conducted on all pediatric patients (aged <15 years) with a mild traumatic brain injury diagnosed at our urban level 1 adult/level 2 pediatric trauma center within 1 year. Subjects were identified by our trauma registry, and medical records were reviewed for demographic data and mechanism of injury. Parents or guardians were interviewed using a standardized questionnaire to collect data regarding the presence or absence of headaches, weakness, numbness, coordination impairment, speech impairment, nausea, vomiting, confusion, short-term memory impairment, sleep disturbances, anhedonia, depression, anxiety, fear, and agitation.

Results: Thirty-three parents of patients responded. The average age of the patients at time of TBI was 9.3±1.7 years. The age range was 3–14 years. The mechanisms of injury included pedestrian struck (54.5%), fall (39.4%), motor vehicle collision (3%), and assault (3%). The time from injury was stratified into 1–3 months (n=9), 4–6 months (n=9), 7–9 months (n=6), and 10–12 months (n=8), one patient surveyed was 14 months post-injury. Headaches (39.4%), anxiety (30.3%), fear (18.2%), and anhedonia (18.2%) were the most frequently reported symptoms. Less common were sleep disturbances (12.1%), depression (9.1%), nausea (6.1%), coordination impairment (6.1%), short-term memory impairment (6.1%), weakness (3%), numbness (3%), vomiting (3%), and agitation (3%). There were no instances of speech impairment.

Conclusions: Approximately 1/3 of patients complained of anxiety post-injury, and 1/5 reportedly experienced anhedonia and fear. Considering the ongoing neurologic and psychosocial development of the pediatric population, long-term follow-up and periodic screening examinations should be considered in patients diagnosed with TBI.

Keywords: pediatric, concussion, persistent symptoms

Introduction

Traumatic brain injury (TBI) is the leading cause of morbidity and mortality in children and adolescents in the US.^{1,2} Even mild TBIs in children are a serious problem, threatening pediatric health and exacerbating the social and economic burden.^{2,3} There is a paucity of data on neurologic and neuro-psychiatric symptoms in pediatric patients with mild TBI within 1-year post-injury.³ The aim of our study was to examine and define the epidemiology of self-reported neurologic and neuro-psychologic symptoms in pediatric patients with mild TBI within 1-year post-injury.

Correspondence: Akella Chendrasekhar
Department of Surgery, Richmond University Medical Center, 355 Bard Ave, Staten Island, NY 10310, USA
Email chendrasekharakella@gmail.com

Methods

We used a telephone based survey. Using our pediatric trauma registry we assessed all pediatric patients (aged <15 years) with mild traumatic brain injury, defined as: GCS of 14 or 15 at the initial examination, no abnormal or focal findings on neurologic examination, no physical evidence of skull fracture, and no radiographic evidence of neurologic injury. We are a 415 bed urban level 1 adult and level 2 pediatric trauma center. We reviewed the medical records for demographics (age, gender, mechanism of injury). During the telephone interview, a parent or guardian was interviewed using a standard questionnaire, shown in [Appendix 1](#). We did not ask any questions about any other pre-existing medical conditions.

The survey posed questions regarding the presence or absence of headaches, weakness, numbness, coordination impairment, speech impairment, persistent nausea, vomiting, confusion, short-term memory impairment, sleep disturbances, anhedonia, depression, anxiety, fear, and agitation. The data were collected and de-identified. As the data were de-identified, we sought and obtained an exemption from our institutional review board [SUNY Downstate] for the study of human subjects. This study was conducted in accordance with the Declaration of Helsinki.

Results

Thirty-three of 50 parents or guardians of mild TBI patients were able to be reached and agreed to an interview. The remainder either had an invalid phone number or refused an interview. The average age of the patients at the time of injury was 9.3 ± 1.7 years, the age range was 3–14 years. The mechanisms of injury were pedestrian struck (54.5%), fall (39.4%), motor vehicle crash (3%), and assault (3%). The time from injury was stratified by 1–3 months ($n=9$), 4–6 months ($n=9$), 7–9 months ($n=6$), 10–12 months ($n=8$), and one patient was surveyed 14 months post-injury.

The reported symptoms included headaches (39.4%), anxiety (30.3%), fear (18.2%), anhedonia (18.2%), sleep disturbances (12.1%), depression (9.1%), nausea (6.1%), coordination impairment (6.1%), short-term memory impairment (6.1%), weakness (3%), numbness (3%), vomiting (3%), and agitation (3%). There were no noted instances of speech impairment. The highest number of symptoms were reported by the 4–6 month post-injury stratified group. We did not have any age-specific disturbances which were evident.

Discussion

Head trauma occurs commonly in children.⁴ Mild TBI is often accompanied by long-term behavioral and neuropsychological defects.^{3,5} Mild TBI usually occurs with head trauma due to contact and/or acceleration or deceleration forces. The type of mechanical forces may determine the nature of the resultant injury.⁶ What effect this injury has on the developing brain is unclear.⁷ Despite the fact that mild TBI seems to be associated with significant morbidity, there is very little data in the literature on long-term sequelae related to mild traumatic injury unrelated to sports injuries. As shown by our telephone survey, there are some unique and persistent symptoms related to mild TBI. The findings of anxiety and fear at the top of our long-term sequelae shows the complex issue of post-traumatic stress disorder. While physicians have been recognizing PTSD associated with major TBI, the recognition of this complex issue in patients with seemingly minor injuries is lacking. This typically leaves families and children in precarious positions of self doubt and self-recriminations. Especially if a child who is having academic and social success prior to injury all of the sudden has a dramatic change in character. Our paper is the first to quantify the complications of injury from a patient and family perspective as fear, anxiety and loss of interest in activities [anhedonia]. The surveyed parents or guardians clearly placed emphasis on noting these issues.

As this was a telephone-based survey, the shortcomings of this study are a lack of physical examination findings. We fashioned the questions to assess family perception of the issues surrounding the TBI. The ability of the parent or guardian to recollect and assess the questions regarding their child was quite clear. The responding parents or guardians showed no hesitation in answering the questions posed of them. The degree of detailed recollection on the part of the parent or guardian was very good. As part of the survey, they were asked about their recollection mechanism of the injury as well as further details. Most were able to accurately state the mechanism and were able to supply further information regarding their interactions with healthcare providers. Of note many voiced frustration in explaining their problems as sequelae of the TBI. As this was initially part of a performance improvement project, we were able to refer the families to take their child

for neuro-psychological testing at our facilities along with further support and follow-up.

Conclusion

Just as children are not “small adults”, the study and addressing of long-term sequelae needs to pay special attention to pediatric issues such as social interaction and academic capacity. The first step, however, is awareness that a minor “head bonk” (TBI) is no minor issue. This places emphasis on follow-up and primary care understanding of mild TBI in children. In our institution we have placed a priority on outreach and trying to establish a community-based understanding of “Mild TBI”.

Considering the ongoing neurologic and psychosocial development of the pediatric population, long-term follow-up and periodic screening examinations should be considered in patients diagnosed with mild TBI.

Acknowledgments

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Disclosure

The author reports no conflicts of interest in this work.

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Supplementary Material

Appendix 1. Pediatric telephone survey post-head injury

Good day. My name is, I am a member of the Trauma Service at Richmond University Medical Center where your child was cared for on

I would like to ask you few follow-up questions and at the end of this survey we will provide you access to support services. Even if you refuse to participate in this survey, if you need we will provide access to support services for your child. These questions relate to the current condition of your child.

1. Is your child still experiencing headaches at a greater frequency than other children within his/her age group? Yes/No
2. Is your child experiencing any unusual symptoms of weakness? Yes/No
3. Is your child experiencing any unusual symptoms of numbness? Yes/No
4. Is your child experiencing any unusual symptoms of coordination impairment (unable to perform simple coordinated movements which would otherwise be normally performed by a child of his/her age)? Yes/No
5. Is your child experiencing any unusual symptoms of speech impairment (any abnormalities of speech which were not evident before the concussive injury)? Yes/No
6. Is your child experiencing any unusual symptoms of nausea? Yes/No
7. Is your child experiencing any unusual symptoms of vomiting? Yes/No
8. Is your child experiencing any unusual symptoms of confusion? Yes/No
9. Is your child experiencing any unusual symptoms of short-term memory impairment? (That is, does your child get up to do something, then halfway forgets what he was trying to do, then looks confused)? Yes/No
10. Is your child experiencing any unusual symptoms of sleep disturbances (nightmares, waking from sleep in an unusual manner)? Yes/No
11. Is your child experiencing any unusual symptoms of anhedonia (loss of interest in things he/she had interest in before the head injury)? Yes/No
12. Is your child experiencing any unusual symptoms of depression (showing lack of interest in interaction with his/her friends, lack of interest in any activities, worsening of performance at school)? Yes/No
13. Is your child experiencing any unusual symptoms of anxiety (nervousness)? Yes/No
14. Is your child experiencing any unusual symptoms of fear? Yes/No
15. Is your child experiencing any unusual symptoms of agitation (being upset)? Yes/No

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