

PEDIATRICS

All-terrain vehicle major injury patterns in children: a five-year review in Southwestern Ontario

Khalid Alawi, MD; Tim Lynch, MD; Rod Lim, MD

ABSTRACT

Objective: The aim of the study was to characterize the nature of the injuries sustained by children involved in all-terrain vehicle (ATV) crashes in Southwestern Ontario over a 5-year period.

Methods: A retrospective chart review was conducted of children who sustained ATV-related trauma and who presented to the emergency department at the Children's Hospital of Western Ontario between Sept. 1, 1998, and Aug. 31, 2003, with an Injury Severity Score (ISS) ≥ 12 . Patients were identified by the London Health Sciences Centre Trauma Program Registry. Patient charts were then retrieved and reviewed to record patient demographics, injuries, interventions and length of stay in hospital.

Results: Seventeen patients, 14 male and 3 female, met inclusion criteria. Ages ranged from 8–17 years, with an average age of 13.7 years. Thirteen were <16 years of age. Overall there were 7 different systems injured in these 17 patients. Fourteen patients sustained an injury to more than 1 system. The average ISS was 22.8. The average length of hospital stay was 9.7 days. Six patients sustained significant head injuries; 4 of these 6 patients were not wearing helmets. Eight patients suffered splenic injuries, and 3 required a splenectomy. Thirteen patients sustained fractures.

Conclusion: ATV trauma is a significant threat to the children in Southwestern Ontario. These results clearly support the Canadian Paediatric Society's recommendation that children <16 years of age should be prohibited from operating or riding on ATVs.

Key words: all-terrain vehicles; children; injury pattern

RÉSUMÉ

Objectifs : Cette étude avait pour but de caractériser la nature des blessures subies par les enfants impliqués dans des accidents de véhicules tout-terrains (VTT) dans le sud-ouest de l'Ontario sur une période de 5 ans.

Méthodes : On effectua une étude rétrospective des dossiers d'enfants ayant subi des traumatismes liés à des VTT et qui furent reçus à l'urgence du Children's Hospital of Western Ontario entre le 1^{er} septembre 1998 et le 31 août 2003 et dont l'Indice de gravité de la blessure (IGB) ≥ 12 . Les patients furent identifiés par le London Health Sciences Centre Trauma Program Registry. Les dossiers des patients furent alors récupérés et étudiés afin de noter les données démographiques, les blessures, les interventions et la durée du séjour à l'hôpital.

Résultats : Dix-sept patients, soit 14 garçons et 3 filles, répondaient aux critères d'inclusion. Leur âge variait entre 8 et 17 ans, l'âge moyen étant de 13,7 ans. Treize patients étaient âgés de <16 ans. Parmi ces 17 patients, on comptait des blessures au niveau de 7 systèmes. Quatorze patients subirent une blessure à plus d'un système. L'IGB moyen était de 22,8. La durée moyenne du séjour

From the Children's Hospital of Western Ontario, University of Western Ontario, London, Ont.

Received: Aug. 27, 2005; revisions received: Mar. 4, 2006; accepted: Mar. 23, 2006

This article has been peer reviewed.

Can J Emerg Med 2006;8(4):277-80

à l'hôpital était de 9,7 jours. Six patients subissent des blessures importantes à la tête; 4 d'entre eux ne portaient pas de casque protecteur. Huit patients subissent des blessures à la rate et 3 durent subir une splénectomie. Treize patients subissent des fractures.

Conclusion : Les traumatismes liés aux VTT constituent une menace importante pour les enfants du sud-ouest de l'Ontario. Ces résultats appuient clairement les recommandations de la Société canadienne de pédiatrie selon lesquelles les enfants âgés de <16 ans ne devraient pas avoir le droit de conduire un VTT ni d'y monter.

Introduction

All-terrain vehicles (ATVs) are commonly used in both urban and rural areas of Canada by children under the age of 16 for both recreational and occupational needs. They appeal to children and their families for many reasons, ranging from their perceived off-road capabilities to their exciting nature. Children, however, may not understand the potential risk of personal injury. Similarly, their parents may be unaware of the potential threat these vehicles pose.

To reduce these risks, the Canadian Paediatric Society (CPS) introduced an evidence-based position statement in 2004 recommending that children <16 years of age should not operate or ride as passengers on all-terrain vehicles.¹ This position was taken without the risks having been adequately quantified. In Western Ontario ATVs are commonplace, especially in the rural areas. The Children's Hospital of Western Ontario (CHWO), within the London Health Sciences Centre (LHSC), serves as a regional referral centre providing specialized pediatric services to children in Southwestern Ontario. CHWO, situated in London, Ont., also serves a significant rural population within Southwestern Ontario.

An increasing number of children in Ontario are being hospitalized as a result of ATV-related trauma. The number of trauma hospitalizations in Ontario related to ATVs increased 45.6% between 1997 and 2002, with 36% of these patients aged 5 through 19 years.² The objective of this report is to describe the nature of injuries sustained by ATVs in children visiting our emergency department (ED).

Methods

A retrospective medical record review was conducted to characterize the nature of the injuries sustained by pediatric patients (<18 years of age) involved in ATV crashes in Southwestern Ontario over a 5-year period between Sept. 1, 1998, and Aug. 31, 2003.

Patients were included if they were <18 years of age and presented to the ED with ATV-related trauma and an Injury Severity Score (ISS) \geq 12, which is considered to be indicative of a major trauma. CHWO's ED has an annual census

of approximately 37 000 visits. Data elements collected were age, gender, ISS, site of injury, helmet use, injuries sustained, ED intervention, blood transfusion history, surgical therapy, hospital length of stay and patient disposition.

Patients were identified by the LHSC Trauma Program Registry, and their charts were then retrieved and reviewed by the principal investigator (K.A.). The Trauma Registry at the LHSC is a prospectively collected comprehensive data set for all severely injured patients (ISS \geq 12) treated at the LHSC, which is 1 of 2 lead trauma hospitals in Southwestern Ontario. The database is maintained by 2 data analysts who are trained in ISS scoring, ICD-10-CA injury coding³ and data entry procedures, with input from an injury epidemiologist. Data are downloaded to the Ontario Trauma Registry at the Canadian Institute for Health Information on a monthly basis. The Collector Trauma Registry software from Digital Innovations is used in a similar manner to most other provinces and many trauma centres in the United States. There are provincial differences in both the inclusion criteria and data elements collected on trauma patients. (i.e., Nova Scotia collects data on all penetrating injuries with an ISS \geq 9, as well as all deaths at the scene and en route to hospital, whereas LHSC only collects ISS \geq 12 for blunt and penetrating injuries and only deaths that occur in the ED or in-hospital. Approval of the study was granted by the University of Western Ontario Ethics Review Board.

Results

A total of 17 patients (14 males [82%]) met the inclusion criteria. Their ages ranged from 8–17 years, with an average age of 13.7 years. Thirteen (77%) patients were <16 years of age. During the 5-year review period, there were 186 221 visits to CHWO's ED. ATV-related trauma was responsible for 87 visits. Overall, there were 392 major trauma patients <18 with an ISS \geq 12 during the same study period. ATV-related injury, therefore, comprised 1.4% (17/392) of major pediatric trauma. Interestingly, in the same region during the same review period there were 26 patients \geq 18 with an ISS \geq 12 who presented to the adult hospital's ED with ATV-related trauma.

Overall there were 7 different systems injured in these 17 patients. Fourteen patients sustained an injury to more than 1 system. The average ISS was 22.8, and there were no deaths. The average length of hospital stay was 9.7 days. All 17 patients were involved in an ATV rollover mechanism of trauma.

Six patients (35.3%) sustained a significant head injury, and 1 patient sustained a diffuse axonal injury. Focal injuries included 2 with intracerebral contusions, an intraparenchymal hemorrhage, an epidural hematoma and a subarachnoid hemorrhage. Four of these 6 patients were not wearing a protective helmet. Overall, 11 patients (65%) wore helmets.

Eight patients (47%) suffered splenic injuries; 5 of them had Grades II, III or IV injuries, and the other 3 sustained Grade V injuries. Three of the patients with Grades I, II and III splenic injuries were managed non-operatively. Two patients suffered Grade IV splenic injuries, with 1 of them requiring a splenectomy. All 3 patients sustaining Grade V injuries required blood transfusions, and 2 of these patients required a splenectomy.

Thirteen patients (76%) sustained fractures. Four of these patients had skull fractures, and there were 3 patients each with pelvic fractures, lower limb fractures, lumbar spine fractures and ribs fractures. One patient sustained an upper limb fracture and 1 sustained a clavicle fracture. One patient required operative fixation for a radius fracture, and another required operative fixation for a femur fracture. One patient sustained a debilitating brachial plexus injury.

Discussion

This paper describes the demographics and characteristics of injuries seen in a population of patients with major ATV-related injuries presenting to a pediatric tertiary referral centre in Southwestern Ontario. There were insufficient cases to identify a specific pattern of injuries, if one exists. The recent CPS position statement outlined several preventive strategies and recommended that children <16 years not use ATVs.¹ Thirteen patients were <16 in this study. The American Academy of Pediatrics (AAP) drafted its policy regarding the use of ATVs by children in 1987, similarly recommending legislation prohibiting the use of ATVs by those <16 years of age.⁴ A recent US case-control study highlights the importance of an age limitation, as outlined by both the CPS and the AAP. The study estimated that ATV drivers ≤15 years of age were nearly 4 times as likely as drivers aged ≥16 or older to be injured.⁵

Splenic injury was the second most common injury in our patients, after fractures. Moreover, the rates of splenic

injury and splenectomy in this study were higher than has been reported in the literature, placing those patients at risk for the greater morbidity and mortality associated with post-splenectomy infection.⁶ Upon detailed review, the 3 patients did meet criteria for splenectomy. Two patients with Grade V injuries were noted to have ongoing intraoperative bleeding, and the 1 patient with a Grade IV injury was noted to have continued, significant active bleeding that was not responding to blood transfusion therapy.

Murphy and Yanchar⁷ described the injuries in 92 patients <16 years admitted to the IWK Health Centre, Halifax, NS, over a 12.5-year period. However, only 13 of those patients had an ISS ≥ 12 compared with 17 in our study. They recorded only 3 patients with splenic injuries compared with our 8. We could not identify any factors that would explain the difference in injury rate. It is possible that patients in our study may have been travelling at higher speeds or may have been taking more risks due to their older ages. Given the study methodology, it is difficult to know if either greater speed and/or greater risk-taking are valid explanations. The advent of more powerful ATV engines with greater speed capabilities and acceleration may also be contributory. Another 5-year review, also conducted in Nova Scotia but involving patients between 16 and 34 years, revealed only 2 patients with splenic injury, neither of whom was reported to require splenectomy.⁸ Yanchar most recently compared patients who presented to the ED of the IWK Health Centre between January 1993 and December 2002 with injuries sustained from bicycling, dirt-biking and motocross bikes, ATVs and motorized vehicles. ATV-related injuries were determined to more closely resemble those from motor vehicle crashes.⁹

Limitations

Our study has several limitations. Sample size does not allow directed comment on injury pattern, preventing any recommendations about preventive interventions. This was not a population-based study but a regional sample of children who were injured severely and required hospitalization. As such, this study may not be generalizable. Moreover, failure to document other pre-existing circumstances limits our understanding of the reasons for the underlying behaviour that led to the ATV crash.

Rural practitioners should be aware of the relevant laws and regulations surrounding ATV use in their particular province or territory. The CPS position statement provides a summary of provincial and territorial ATV vehicle legislation, age restrictions and helmet requirements.¹ Physicians (i.e., family physicians, emergency physicians and

pediatricians alike) should incorporate the CPS position statement in their anticipatory guidance in patients <16 years of age. Further research is required to gain a better understanding of the awareness and attitudes of adolescents and their parents regarding ATVs.

Conclusion

ATV crashes have led to serious injury in children in Southwestern Ontario. These results support the CPS recommendation that children <16 years of age should be prohibited from operating or riding on ATVs.

Competing interests: None declared.

Contributors: All three authors contributed equally to all stages of the research project and manuscript preparation.

Acknowledgements: Special thanks to Joyce Williamson and Tanya Charyk-Stewart of the London Health Sciences Centre Trauma Program, Claire Beadle in Medical Records along with Jamie Seabrook and Dr. Kathy Speechley for their advice and assistance.

References

1. Canadian Paediatric Society Injury Prevention Committee. Preventing injuries from all-terrain vehicles [position statement]. *Paediatr Child Health* 2004;9:337-40.
2. Canadian Institute for Health Information. All terrain vehicle (ATV)-related trauma hospitalizations in Ontario, 2001–2002. *Ont Trauma Reg Analytic Bull* 2003;Dec.
3. Canadian Institute for Health Information. The Canadian enhancement of ICD-10 (International statistical classification of diseases and related health problems, 10th rev). Final Report. 2001. Available: www.cihi.ca/cihiweb/dispPage.jsp?cw_page=codingclass_icd10_e (accessed 2006 Mar 27).
4. American Academy of Pediatrics Committee on Injury and Poison Prevention. All terrain vehicle injury prevention: two-, three-, and four-wheeled unlicensed motor vehicles. *Pediatrics* 2000;105:1352-4.
5. Rodgers GB, Adler P. Risk factors for all-terrain vehicle injuries: a national case-control study. *Am J Epidemiol* 2001;153(11):1112-8.
6. Bisharat N, Omari H, Lavi I, et al. Risk of infection and death among post-splenectomy patients. *J Infect* 2001;43:182-6.
7. Murphy N, Yanchar N. Yet more pediatric injuries associated with all-terrain, vehicles: Should kids be using them? *J Trauma* 2004;56:1185-90.
8. Sibley AK, Tallon JM. Major injury associated with all-terrain vehicle use in Nova Scotia: a 5-year review. *Can J Emerg Med* 2002;4(4):263-67
9. Yanchar NL, Kennedy R, Russell C. ATVs: motorized toys or vehicles for children? *Inj Prev* 2006;12:30-4.

Correspondence to: Dr. Khalid Alawi, Children's Hospital of Western Ontario, 800 Commissioners Rd. E, London ON N6M 1K3