

Incidence and Injury Types in Motorcycle Collisions Involving Deer in Western New York

Bradley W. Smith, MD, Cathy M. Buyea, MS, and Mark J. Anders, MD

Abstract

Motorcycle popularity, urban sprawl, and large deer populations result in a significant number of deer–motorcycle collisions. This retrospective review of a level I trauma center in Buffalo, New York, revealed that 40 of 487 (8.2%) of patients admitted because of motorcycle crashes from May 2007 through June 2011 involved deer. There were 120 total injuries: the most common were orthopedic (39/120; 32.5%), chest (38/120; 31.7%), head (18/120; 15.0%), spine (10/120; 8.3%), facial (8/120; 6.7%), and abdominal (7/120; 5.8%). Thirty-five of 40 (87.5%) were men and were older (48.9 years, [SD, 8.9 years]) than the average for all motorcycle crashes during the study period (41.9 years, [SD, 13.9 years]). Mean (SD) injury severity score was 17.1 (9.8), reflecting the severity of encountered injuries. This study highlights the relatively common risk that deer pose to the motorcyclist and is comparable to published series in more rural Midwestern settings.

The combination of urban sprawl and a large deer population has caused deer–motor vehicle collisions to become a major concern over the past few decades. According to State Farm Insurance industry data, New York State drivers in 2010–2011 had a 1 in 149.5 likelihood of colliding with a deer over the year, compared with a national average of 1 in 183.4.¹ Reports from the Midwest have highlighted the frequency and severity of this type of accident.^{2–4} Frequent performance of orthopedic procedures in this subset of trauma patients prompted a local review to determine the frequency and severity of injuries. This series differs from the Midwest studies in the existence of a universal helmet law for all motorcyclists and passengers in New York State. Other studies looking at this type of accident were performed in states, including Minnesota and Wisconsin, that require helmets only for riders younger than 18 years or persons with an instructional permit.⁵

The Erie County Medical Center (ECMC) is a level I trauma center located in Buffalo, New York, and serves much of west-

ern New York, as well as part of northwestern Pennsylvania and, occasionally, southern Ontario, Canada. Because the ECMC receives almost all major trauma cases in the region, we had sufficient records to explore the incidence and the severity of deer–motorcycle accidents in these regions. In addition to adding to the limited data analyzing crash outcomes, we also looked at the numbers and proportions of motorcycle accidents attributable to deer and compared these with results from studies from different geographical regions. Because the number of registered motorcycles in Erie County is among the highest in New York State, and because of the increased severity of motorcycle–deer collisions relative to other motor vehicle–deer collisions, this issue has both safety and financial considerations.

Materials and Methods

A retrospective review of records from ECMC was performed to capture all records from motorcycle accidents from May 2007 through June 2011. The population was identified to include only motorcycle accidents that were caused by collision with deer.

Injury severity was standardized using the Injury Severity Score (ISS), and the level of consciousness on arrival was standardized using the Glasgow Coma Scale (GCS). Chart abstraction included patient age, identification of the patient as driver or passenger of the motorcycle, use of helmet, time of year, types of injuries, length of hospital stay, and whether the patient lost consciousness. Patient age was also abstracted for the entire initial screen of all motorcycle accidents regardless of mechanism.

Statistical analysis was done using SPSS (IBM SPSS Statistics for Windows, Version 19.0; IBM Corp., Armonk, New York). Continuous data were analyzed using the appropriate descriptive statistics. Comparisons were made using Student *t* test, and a 0.05 level of significance was accepted.

Results

The initial screening of the trauma database returned 487 patients who had been involved in a motorcycle accident; of these, 39 patients were in an accident that involved a deer. According to one medical record, the spouse of a

Authors' Disclosure Statement: The authors report no actual or potential conflict of interest in relation to this article.

patient was a passenger who was dead at the scene, although there was no separate medical record for this person; this person was included in our data. Therefore, our total study population numbered 40 patients involved in 36 accidents, with 36 drivers and 4 passengers; 35 were men and 5 were women, with the women accounting for all 4 passengers and 1 driver. The mean (SD) patient age for deer–motorcycle collisions was 48.9 (8.9) years (range, 21–64 years). This was significantly higher than the mean (SD) age for all motorcycle accidents from the ECMC trauma database, which was 41.9 (13.9) years (range, 17–79 years) ($P < .002$).

The majority of accidents (31; 86%) with deer occurred during the months of May through September, with the most occurring in June (11; 31%). There was only 1 (3%) in October, 3 (8%) in November, and 1 (3%) in January. The number of collisions per year averaged 9.75, with a range of 8 to 12 from 2007–2010. (The year 2011 was omitted because data were collected before the year was complete). The presence or absence of helmet use was recorded in 22 cases. Of these, 21 patients had been wearing a helmet (95%), and only 1 patient was unhelmeted. Among all riders involved in motorcycle accidents from the trauma database, the presence or absence of a helmet was recorded in 271 cases. Of these, 262 (97%) were wearing a helmet. The average length of hospital stay was 6 days, with 6 patients having stays that were 10 days or longer, and the longest stay was 31 days. Thirty-three medical records noted whether the patient described loss of consciousness after the accident; of these, 14 (42%) claimed loss of consciousness and the remaining 19 (58%) denied any loss of consciousness after the accident. The mean (SD) ISS for deer–motorcycle collisions was 17.1 (9.8), and the mean (SD) GCS was 14.3 (2.5).

Chest, orthopedic, and head injuries were the most common injuries seen in deer–motorcycle collisions (Table). Head injuries, including the 1 patient who was confirmed to not have been wearing a helmet, accounted for 15.0% of the total injuries. This patient also had a longer length of stay at 19 days than the average of 6 days. Rib fractures were the most common injury, occurring in 20 (50%) patients. The 1 recorded fatality was the passenger of a patient who was dead at the scene.

Twenty-five (62.5%) patients in this series had injuries that are traditionally treated by orthopedic trauma surgeons, including scapular, clavicle, pelvic, and extremity fractures. Upper and lower extremity injuries occurred 10 (8.3%) and 15 (12.5%) times respectively, with the lower extremity injuries including long bone fractures,

Table. Types of Injuries Sustained in the Chest, Orthopedic, Head, and Facial Regions by Motorcyclists Involved in Deer–Motorcycle Collisions

Type of Injury	Incidence	% of Total Injuries
Chest Injuries		
Rib fracture	20	16.7
Pneumothorax	10	8.3
Sternal fracture	2	1.7
Lung contusion	5	4.2
Heart contusion	1	0.8
Subtotal	38	31.7
Orthopedic Injuries		
Clavicle fracture	6	5.0
Scapular fracture	5	4.2
Upper extremity fracture	10	8.3
Pelvic fracture	3	2.5
Lower extremity fracture	11	9.2
Foot and ankle fracture	3	2.5
Lower extremity traumatic amputation	1	0.8
Subtotal	39	32.5
Head Injuries		
Closed head injury	9	7.5
Subarachnoid hemorrhage	6	5.0
Subdural hematoma	1	0.8
Skull fracture	1	0.8
Petechial hemorrhage	1	0.8
Subtotal	18	15.0
Spinal Injuries		
Spine fracture	7	5.8
Disc herniation	2	1.7
Cauda equina syndrome	1	0.8
Subtotal	10	8.3
Facial Injuries		
Nasal fracture or deviated septum	3	2.5
Orbital fracture	2	1.7
Maxillary fracture	1	0.8
Tripod fracture	1	0.8
Teeth fractures with lip laceration	1	0.8
Subtotal	8	6.7
Abdominal Injuries		
Splenic laceration	4	3.3
Hematoma	2	1.7
Urethral disruption and bladder rupture	1	0.8
Subtotal	7	5.8
Total	120	100.0

foot and ankle fractures, and 1 lower extremity traumatic amputation. Fourteen (35%) patients underwent one or more orthopedic surgical procedures.

Discussion

Although animal–vehicle collisions have been described in the literature, comparatively little data are available for the subset of animal–motorcycle accidents. This is an important gap considering that fatalities in collisions with animals were 6 times more likely to be persons riding motorcycles, although animal collisions are more common with other vehicles.⁶

Smoot and colleagues² also reported that motorcycle collisions with deer tend to result in a higher injury severity than collisions of other vehicles with deer. According to reports for Midwestern regions, motorcycle-versus-deer accidents are a significant problem, causing a large number of serious injuries as well as creating the financial burden of vehicle damage and medical costs.^{2,3} However, the overall data are limited, and there is not much detailed information available for western New York.

Because of the large number of motorcyclists in New York State, it is important to consider accident data in this subset of the population. In 2010, 340,260 motorcycles were registered in New York State, with Erie County having the second highest number (21,745) of motorcycles registered.⁷ These numbers increased to 345,820 and 22,183 motorcycles, respectively, in 2011.⁸ In that year, the number of police-reported motorcycle accidents in New York decreased to 4855 from 5047 accidents in 2010, although both numbers are increased from 4647 accidents in 2009.^{9–11} Despite the decrease in total police-reported motorcycle accidents from 2010 to 2011, the trend in motorcycle accidents involving an animal's action has steadily increased from 313 (6.7%) in 2009 to 335 (6.6%) in 2010 to 401 (8.3%) in 2011.^{9–11} Although these data from the New York State Department of Motor Vehicles are not further broken down by animal species, it can be reasonably surmised that most of these are caused by deer. This inference is supported by data from Bramati and colleagues⁴ showing that 81% of animal–vehicle collisions involved deer, as well as by the *Wildlife-Vehicle Collision Reduction Study* that showed deer were involved in 54.4% of animal–vehicle collisions in California and more than 90% of animal–vehicle collisions in Illinois and Minnesota.^{4,12} These studies predominantly comprised collisions involving animals capable of causing substantial property damage on impact, such as deer or larger animals. This, along with the evidence of higher ISS seen in motorcyclists in deer-related traffic injuries,² supports the intuitive thought that motorcyclists are at increased risk for injury and fatality relative to other motor vehicles involved in accidents.

Williams and Wells¹³ reviewed 147 fatal wildlife–vehicle fatalities from 9 regions and found that the 2 most common fatalities were the motorcycle driver or passenger after striking an animal or an object. Jones¹⁴ also reported that the most common fatal wildlife–vehicle crashes involved motorcycles,

as did fatal-accident reporting system data in the *Wildlife-Vehicle Collision Reduction Study*, which confirmed that approximately 30% of fatal crashes with animals involved motorcycles.¹²

Interestingly, the age of patients involved in motorcycle–deer collisions tends to be higher than that of patients involved in other motorcycle accidents. The numbers in our study reflect results in other study populations that suggest motorcycle riders who collide with deer are generally older than riders in other accidents who are more likely to be younger.⁴ One explanation is that younger riders may drive faster and more recklessly than older and experienced riders, resulting in an increased number of accidents unrelated to deer. Another consideration places younger drivers less commonly on roads where wildlife crashes more often occur (ie, roads that are rural, 2-lane).

Helmet use, when reported, was very high in our study population, most likely as a result of New York State's mandatory helmet law for motorcyclists. Our data showed that more than 95% of patients whose charts documented helmet usage were wearing helmets at the time of the collision, compared with a Wisconsin study showing that only 29% of patients were wearing helmets.³ This may explain the proportion of head injuries in our study being 15.0% compared with the 29.5% in the Wisconsin study.³ Although both datasets involved a limited number of patients, the results suggest that mandatory helmet laws are effective in preventing head injuries. Also, the only patient in our study who was confirmed to have not been wearing a helmet had a much longer length of hospital stay than the average patient (19 vs 6 days). William and Wells¹³ found that 65% of motorcyclists killed in collisions with animals were not wearing helmets, and they believed that many of these fatalities could have been prevented with helmet use. Again, these limited data suggest the effectiveness of mandatory helmet use.

Two other factors, season and time of day, are important to consider in motorcycle collisions with deer. According to our data, 86% of these collisions occur in the warmer months, May through September, peaking in June. This is similar to findings from the Wisconsin study showing June and July as the peak months for deer–motorcycle collisions and a study in Minnesota where 61% of these crashes occurred in the summer months.^{2,3} These data most likely indicate increased motorcycle traffic in favorable weather conditions. Although time of accident could not be determined through our retrospective review, multiple studies have shown that the majority of collisions with deer tend to be between dusk and dawn. Smoot and colleagues² found that 56% of vehicle collisions with deer occurred between 5 PM and midnight, with 80% between 5 PM and 6 AM.² Similarly, Nelson and colleagues³ found that 54.5% of collisions happened in a 4-hour period, from 6 PM to 10 PM. These data indicate that motorcycle operators should be especially vigilant in the morning and evening hours when deer may be more active.

Other than driver awareness and vigilance, prevention efforts can involve wildlife fencing, alert systems, and deer-culling programs. Fences are used extensively, most com-

monly on larger thoroughfares, and have been shown effective in reducing wildlife vehicle crashes by 80% to 90%.¹² Animal detection systems using sensors to detect large wildlife approaching the roadway can activate warning signs to alert approaching drivers. Such systems have been installed in more than 30 locations in North America and Europe with variable effectiveness.¹² However, there are typically no standards or guidelines for the collection of data about wildlife–vehicle crashes. Data are collected inconsistently and often haphazardly, and methods vary between states and agencies. Some transportation agencies do not collect this type of data at all. Without reliable, consistent data, it is difficult to identify road sections where mitigation methods may be required, to select appropriate mitigation measures, or to evaluate whether that effort is making a difference.

Culling systems for deer populations are frequently discussed, often in suburban as well as rural settings. Recreational hunting ordinances, higher limits on the number of females a hunter can bag, and occasional use of professional shooters can be applicable in less rural areas. Their effectiveness is debatable and tends to be time-limited.

Conclusion

This study highlights the fairly common occurrence and relative severity of deer–motorcycle crashes in an upstate New York setting, approximating published series from the Midwest. Helmet laws may lower rates of head injury in motorcycle–wildlife crashes. Finally, there are no fender benders when the chosen vehicle sports no fenders, so motorcyclists need to be especially vigilant in order to avoid collisions with deer and other wildlife.

Dr. Smith is Resident, Akron General Medical Center, Akron, Ohio. Ms. Buyea is Research Coordinator and Dr. Anders is Clinical Associate Professor, Department of Orthopaedic Surgery, State University of New York at Buffalo, Buffalo, New York.

Address correspondence to: Bradley W. Smith, MD, Department of Orthopaedics, Akron General Medical Center, 1 Akron General Drive, Akron, OH 44307 (tel, 330-344-6269; e-mail, Bradley.smith@akrongeneral.org).

Am J Orthop. 2015;44(6):E180-E183. Copyright Frontline Medical Communications Inc. 2015. All rights reserved.

References

1. Likelihood of collision with deer (amended 2010-2011). State Farm website. https://static1.st8fm.com/en_US/content_pages/1/pdf/us/likelihood-of-collision-2011.pdf. Accessed April 29, 2015.
2. Smoot DL, Zielinski MD, Cullinane DC, Jenkins DH, Schiller HJ, Sawyer MD. Patterns in deer-related traffic injuries over a decade: the Mayo Clinic experience. *Scand J Trauma Resusc Emerg Med.* 2010;18:46.
3. Nelson RS, Gustafson PT, Szlabick RE. Motorcycle collisions involving white-tailed deer in central and northern Wisconsin: a rural trauma center experience. *J Trauma.* 2006;60(6):1297-1300.
4. Bramati PS, Heinert LF, Narloch LB, Hostetter J, Finkielman JD. Animal-related motorcycle collisions in North Dakota. *Wilderness Environ Med.* 2012;23(1):65-69.
5. Save lives, save money – how does your state measure up. Injury Prevention & Control: Motor Vehicle Safety. Centers for Disease Control and Prevention website. <http://www.cdc.gov/motorvehiclesafety/mc/states/index.html>. Updated June 13, 2012. Accessed April 23, 2015.
6. Langley RL, Higgins SA, Herrin KB. Risk factors associated with fatal animal-vehicle collisions in the United States, 1995-2004. *Wilderness Environ Med.* 2006;17(4):229-239.
7. Vehicle registrations in force – 2010. Archives of Statistical Summaries. New York State Department of Motor Vehicles website. <http://dmv.ny.gov/statistic/regin10.pdf>. Accessed May 11, 2015.
8. Vehicle registrations in force – 2011. Archives of Statistical Summaries. New York State Department of Motor Vehicles website. <http://dmv.ny.gov/statistic/regin11.pdf>. Accessed May 11, 2015.
9. Summary of motorcycle crashes – 2011. Archives of Statistical Summaries. New York State Department of Motor Vehicles website. <http://dmv.ny.gov/statistic/2011MotorcycleCrashSummary.pdf>. Accessed April 23, 2015.
10. Summary of motorcycle accidents – 2010. Archives of Statistical Summaries. New York State Department of Motor Vehicles website. dmv.ny.gov/statistic/2010MotorcycleAccSummary.pdf. Accessed April 23, 2015.
11. Summary of motorcycle accidents – 2009. Archives of Statistical Summaries. New York State Department of Motor Vehicles website. dmv.ny.gov/statistic/2009MotorcycleSummary.pdf. Accessed April 23, 2015.
12. Huijser MP, McGowen P, Fuller J, et al; Federal Highway Administration. *Wildlife-Vehicle Collision Reduction Study: Report to Congress*. Report no. FHWA-HRT-08-034. Washington, DC: US Department of Transportation, Federal Highway Administration; 2008. <http://www.fhwa.dot.gov/publications/research/safety/08034/08034.pdf>. Accessed April 23, 2015.
13. Williams AF, Wells JK. Characteristics of vehicle-animal crashes in which vehicle occupants are killed. *Traffic Inj Prev.* 2005;6(1):56-59.
14. Jones M. Deer-vehicle crash injuries, fatalities reach all-time high in Wisconsin. *Milwaukee Journal Sentinel.* April 14, 2000:1B-2B.

This paper will be judged for the Resident Writer's Award.
