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Childhood motocross truncal injuries: high-velocity, focal force to the chest and abdomen

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ABSTRACT

Objectives: To review the need for operative intervention and critical care services for motocross truncal injuries in children.

Design cohort: Retrospective review of patients identified via the hospital trauma registry.

Setting: Our Level 1 Pediatric Trauma Center serves five motocross tracks. These patients require frequent medical care for injuries.

Participants: All patients ≤17 years of age with truncal injuries sustained during motocross activities, between 2000 and 2011, were identified through the trauma registry.

Primary and secondary outcome measures: Operative intervention, intensive care unit (ICU) admission, length of stay, morbidity and demographics were reviewed.

Results: Motocross injured 162 children. Thirty (18.5%) were thoracic or abdominal injuries. Operative intervention was required in eight (27%) patients. Mean injury severity score (ISS) was 11.8. ICU admission was required in 50% and average hospital length of stay was 4.1 days. The most common injuries include pulmonary contusion, pneumothorax, spleen and liver lacerations. 13% of subjects suffered truncal injury from motocross on more than one occasion.

Conclusions: Paediatric motocross-related truncal injuries are significant. Surgical intervention is required in 27% of patients. The lower ISS incurred from motocross combined with high surgical and ICU admission rates suggests focal high-impact injuries to the chest and abdomen. Despite significant injury, 13% of motocross patients suffer recurrent injuries. Parents and children need injury prevention education.

ARTICLE SUMMARY

Article focus

- Motocross is a popular competition sport for adolescents in mid-west USA but can result in significant truncal injury.
- We hypothesise that these children require frequent intense hospital care and operative intervention.

Key messages

- In total, 50% of children with truncal injuries from motocross require intensive care unit admission.
- 27% of children with truncal injuries from motocross require operative intervention.
- Recidivism is problematic. 13% suffer significant truncal injury on more than one occasion.

Strength and limitations of this study

- To date, this has been the first and only study exploring thoracic and abdominal injuries in motocross riders.
- Study population is an elite group of children (motocross riders) with specific injuries (thorax and abdomen). These injury patterns are not applicable to other groups.
- Data are limited by the retrospective nature of this study.

INTRODUCTION

Motocross is a popular recreational activity in Minnesota. There are 15 motocross tracks in the state, with 5 in the local region of our Level 1 Pediatric Trauma Center. Motocross race events occur on most weekends throughout the summer, with 100–250 youth registrants per race. Healthcare professionals at our rural, tertiary care hospital have noticed severe injuries in children and teens participating in motocross events. Specifically noted were abdominal and thoracic injuries, many of which required surgery and/or intensive care unit (ICU) admission.

Given that no studies have been published in children to date exploring the relationship between truncal injuries from motocross, this study was designed retrospectively to review our experience and quantify those observations. We hypothesise that paediatric truncal injuries sustained during motocross require frequent operative intervention and admission to the ICU.

MATERIALS AND METHODS

All patients 17 years of age and younger with truncal (abdomen and/or thorax) injuries

sustained during motocross activities presenting to our institution between 2000 and 2011 were identified through our trauma registry. The trauma registry collects standardised data from all level 1 and 2 trauma activations presenting to the emergency department, as well as all hospital admissions due to trauma. Our hospital is a large tertiary care facility and level 1 trauma centre in rural Southeastern Minnesota.

Cases were included for analysis if the injury was located in the thorax and/or abdomen and had visceral involvement. Isolated orthopaedic fractures (ribs, clavicles and vertebrae) and minor soft tissue injuries were excluded. Review of the medical record was performed for all cases by the first author of this paper. Demographic data collected included age and gender. Primary outcomes examined included anatomic injury location, operative procedure, hospital length of stay, ICU admission, injury severity score and mortality. Charts were also reviewed for subsequent or previous documentation of truncal injury from motocross.

Research protocol was reviewed and approved by the Institutional Review Board at Mayo Clinic, Minnesota. All authors have contributed equally to this work. We have no conflicting interests to disclose.

RESULTS

The trauma registry identified 162 paediatric motocross trauma patients over an 11-year period, with 30 (18.5%) of these injuries to the chest and/or abdomen. Children ranged in age from 11 to 17 years. All patients were man (100%). There were no mortalities.

ICU admission was required in 50% of patients. Average ICU length of stay was 1.4 days (range 1 – 5 days). The overall mean hospital length of stay was 4.1 days (range 1–12 days). The average injury severity score (ISS) was 11.8 (range 4–29).

Injuries included lung contusions, pneumothoraces, penetrating abdominal wall wounds, small bowel injuries, retroperitoneal haematomas and spleen, kidney and liver lacerations (table 1). Boney injury was seen only in association with injury to the thorax and included fractures of the sternum, ribs, clavicles and vertebrae. These fractures were associated with underlying pulmonary contusions and pneumothoraces. The most common injuries (in descending order) were pneumothoraces, lung contusions and splenic lacerations. Nine of 14 patients with thoracic injury had multiple injuries within the chest. Injury to the abdomen affected only a single abdominal site in all cases. Two patients had injury to both the chest and abdomen.

Surgical intervention was required in 27% (n=8) of patients. Operative procedures performed included exploratory laparotomy, splenectomy, tube thoracostomy and ureteral stent insertion and are summarised in table 2.

On chart review, it was noted that several individuals injured during motocross had repeat hospital visits for previous or subsequent motocross injuries sustained outside our study interval. Specifically, 13.3% had recurrent truncal injuries from motocross recorded at our institution. These injuries tended to be severe despite prior experience. Recidivism event details are available in table 3.

Table 1 Description of injuries

Injury description	Number of patients (n)	%
Thorax	14	47
Pneumothorax	10	33
Lung contusion	9	27
Rib fracture	5	17
Vertebral fracture	3	10
Clavicle fracture	2	7
Sternum fracture	1	3
Abdomen	18	60
Spleen laceration	8	23
Liver laceration	4	13
Penetrating wound to abdominal wall	2	7
Retroperitoneal hematoma	2	7
Kidney laceration	1	3
Small bowel injury	1	3
Multiple injuries	11	37
Multiple thoracic injuries	9	30
Multiple abdominal injuries	0	0
Thoracic and abdominal injuries	2	7

DISCUSSION

Motocross is a competitive sport. In motocross events, children drive motorised vehicles, at upwards of highway speed, navigating sharp curves and flying over jumps. Not surprisingly, motocross can produce significant injury in children. Little published research is available pertaining to injuries from motocross, with even less with regard to the paediatric population. However, no studies have been published to date specifically addressing truncal injuries in children due to motocross (ie, injuries encountered by the paediatric general surgeon).

A recent study from our institution explored paediatric motocross injuries and their economic implications.[1] The overall surgery rate was 30%, with 89% of surgeries being orthopaedic in nature.[1] This study was consistent with others that have found the majority of injuries from

Table 2 Operative procedures

Operative procedure	Number of patients (n)	%
Exploratory laparotomy	3	10
Splenectomy	2	7
Tube thoracostomy	2	7
Ureteral stent	1	3
Total operative patients	8	27

Table 3 Patient recidivism details

Patient	First injury	Second injury
1	Bilateral retroperitoneal haematomas	Rib fractures and pneumothorax
2	Rib, clavicle and scapula fracture with pulmonary contusions	Pulmonary contusion
3	Splenic injury requiring splenectomy	Sternal fracture and pulmonary contusions
4	Chest contusion	Splenic injury requiring splenectomy

motocross to be typically orthopaedic in nature, with the lower limb being the most frequent.[1–4] This study found that 47% of general motocross injuries required admission to the hospital, with 7% going to the ICU.[1] Most of these ICU admissions are likely truncal injuries, as our study identified a 50% ICU admission rate for children with truncal injuries.

Other studies indicate injuries to the chest range 4–23% and abdomen 2–15% in adult motocross injuries.[2 3] Paediatric data available in the literature pertain to recreational dirtbike use, with a paucity of information on competitive motocross for kids and teens. Description of truncal injury and treatment/surgery required has also not been detailed in previous publications. Our results suggest that paediatric motocross injuries involve the trunk in 18% of cases. The most common injuries were pulmonary contusions, pneumothoraces and spleen lacerations. The majority of these injuries were managed successfully with non-operative care; however, 27% required operative intervention.

Other studies have examined recreational motorbike or dirtbike injuries in children; however, it may not be accurate to compare recreational motorbike riding to competitive motocross. Motocross entails high speed, with jumps, obstacles and many racers nearby. Motocross therefore has theoretical potential for more significant and frequent injury.

Robertson and Garrett[5] examined paediatric motorbike injuries in Australia. They determined an average ISS score of 5 for all injuries from motorbike crashes. This is lower than our ISS of 8.8 for all motocross injuries (data not shown) and 11.8 for truncal trauma. Pomerantz *et al*[6] reviewed paediatric motorbike injuries in Ohio. They found an average ISS of 9.9 and hospital length of stay 4.6 days, which is more consistent with our data.

Our data indicate that truncal trauma is common in paediatric motocross injuries (18.5%). Truncal trauma appears more common in motocross riders than in children riding recreational motorbikes. Pomerantz *et al*[6] found truncal trauma in 13% of kids injured on motorbikes, while Yanchar *et al*[4] found 10% truncal injuries in paediatric dirtbike injuries. However, our paediatric data are similar to adult motocross studies. In a 12-year review of motocross injuries, Gobbi *et al*[7] found truncal trauma in 21% of adult cases. Gorski *et al*[2] found higher rates, with 23% chest and 15% abdominal injuries among adult motocross riders. Physicians should have a high suspicion for truncal trauma in patients presenting after a motocross crash.

At our institution, over an 11-year period, motocross injured 162 children severely enough to warrant level 1–2 trauma activation and/or hospital admission. Furthermore, our data suggest that motocross can produce significant truncal trauma in children. In fact, 27% of injuries to the thorax or abdomen required operative intervention. More alarming is that 13% have suffered significant truncal trauma from motocross on more than one occasion. These data represent injuries presenting to our single hospital. The rate of recidivism may in fact be higher if treatment has also been sought elsewhere.

It is interesting to note that motocross had the higher rate of truncal surgery (27%) than general paediatric trauma would expect. Furthermore, 50% of patients required admission to the intensive care unit. However, average injury severity score remained low (11.8). The lower ISS and higher surgery and ICU admission rate incurred from motocross suggests focal high-impact injuries to the chest and abdomen. When examining a child with chest or abdominal injury following motocross crash, physicians should be watchful for severe focal truncal injury in the light of an otherwise low ISS. One in four of these children may require surgery.

This study is limited by its retrospective design and small sample size. Our findings represent the paediatric motocross patients in southeast Minnesota, USA and may not apply to other populations. Likely, not all injured motocross riders were captured by our hospital records. Less severely injured participants may have reported to smaller community hospitals for treatment. However, all level 1 and 2 traumas (those included in this study) should have been referred to our hospital as we are the only level 1 trauma centre in the region of five motocross tracts.

Protective equipment, such as chest guards and kidney belts, may play a role in preventing truncal trauma. Unfortunately, data pertaining to protective equipment worn at the time of injury was not available from our trauma registry. We are therefore unable to assess that hypothesis. Parents and children should be counselled about proper safety precautions and potential for severe internal injury during motocross activities. Further prospective studies evaluating safety practices during motocross events are underway.

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