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Original Article

A review of the number and severity of injuries sustained following a single motocross event

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ABSTRACT

Background: Competitive and recreational motocross is an increasingly popular sport in Australia and worldwide. Children as young as 4-year-old can participate in this activity. It is recognised that this is a high risk sport despite the use of protective equipment and developments in course design. Injuries sustained range from minor contusions and fractures to severe life threatening spine and head injuries in adults and the paediatric population. In addition organised events can generate a surge of trauma that can burden small local hospitals, resulting in an unpredicted increase in the workload with subsequent delays to treatment. We present the trauma workload generated in a district hospital following a single motocross event.

Method: All patients attending a district hospital emergency department with injuries sustained during a single motocross event were identified through hospital and ambulance records. The nature of their injuries and the treatment required, the length of hospital stay and operative theatre time generated by their injuries were obtained from hospital and theatre records.

Results: 14 patients attended the emergency department over a 24-hour period, requiring 5 ambulances from the scene. 7 patients required hospital admission with 7 operations performed, consuming 12.2 h of operating theatre time and 21 days of hospital beds. 2 patients sustained head injuries requiring observation, one of which was transferred to a spinal unit for management of their spinal injuries.

Conclusion: Motocross is a popular sport and at times has unacceptable risks of injury in organised competitions, especially with regards to paediatric injuries. Better course design, restrictions on participant age and limitations in vehicle speeds may help reduce the number of severe injuries. These events can also generate a sudden trauma burden to local hospital facilities with knock on effects on waiting times for theatre and potentially compromising not only treatment of the injured participants but also the treatment of other patients in the hospital. Cooperation with event organisers may enable extra staff and theatre time to be arranged in advance but at increased cost to the local health services.

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1. Introduction

In Australia motocross is an increasingly popular sport and worldwide is the fastest growing action sport. The combination of acceleration, jumps and increasingly challenging all terrain circuits has made this an attractive and competitive sport for adults and children. However it is also these characteristics that make this a high-risk sport with potentially devastating injuries for young children and adults. Riders reach speeds of 40–50 km/h in seconds and can jump metres in the air. Current protective clothing guidelines for motocross stipulate riders must wear⁶: helmet (AS1698 approved), Motocross boots covering $\frac{3}{4}$ of leg, gloves of leather or similar durability, body armour (including chest, shoulder, elbow and forearm protection) and goggles. Additional equipment commonly used but not required for racing includes: Neck braces, knee braces, back protectors, kidney belts and hip protectors. Riders must be proven to be competent at controlling the bike to enter, and are limited to age matched groups. The peak body that regulated these events, Motorcycling Australia (MA) has continued to formalise more structured regulations around events to include minimum protective clothing, track design and inspection, and risk analysis. In recent years, triple jumps have been banned, spaced out jumps have now been controlled with tabletops and large stutters have decreased in size and length. There are now structured guidelines around track design, including minimum widths, length, amount of riders on track, maximum track speeds (no more than 55 kph average speed/lap), marshalling, obstacle protection, all of which requires approval by MA certified track inspector.⁷ Despite these precautions, the incidence of minor and severe paediatric and adult trauma remain common. Major organised events have the potential to overload nearby hospitals with multiply injured patients. This can result in delayed treatment and reduction in the standard of healthcare received by patients.

2. Methods

We reviewed all the charts of patients presenting to the Department of Emergency Medicine at Nambour Hospital over a single weekend, which coincided, with the local Sunshine state Motocross series. The Sunshine State Motocross Series is one of the largest non-championship domestic series in Australia.⁸ These events attract a variety of riders from semi-professional to weekend amateur club riders and juniors. Patients attending the department following an injury sustained at this event were included in the study. Injuries sustained from motocross accidents not involved in this event or on road motorbike accidents were not included. The Queensland ambulance service and event organisers were contacted to identify other injuries that may have been treated in other hospitals. Data from the nearby private hospital or from the event organisers of injuries managed by the onsite medical team was not included. The event organisers also provided the data on numbers of participants. The severity of injuries, number of investigations, their subsequent treatment and length of hospital stay were obtained

from hospital records. The number of hours of theatre time was obtained from theatre records. A literature search was used to obtain data on the frequency and severity of injuries commonly associated with this sport.

3. Results

Of the 150 patients that attended the emergency department over the 2 days, 14 were attending after sustaining injuries at the motocross event, constituting an increase of 9.3% of presentations to the hospital. There were 460 participants in the event, 3% of which required referral to hospital for further treatment. All 14 patients were male aged 11–41 years (average 21.3). Together they required 5 ambulances, 56 individual X-rays, 4 CT scans and 1 USS.

Some sustained only ligamentous injuries and contusions but several had multiple fractures. 7 patients required admission to hospital for further treatment, analgesia or observation for a head injury. Their injuries resulted in 7 operations consuming 12.2 h of emergency theatre time, and occupying 21 days of hospital beds (av. 3 days). One patient sustained a head injury with a prolonged period of unconsciousness and post-traumatic amnesia. He had multiple spine fractures and was later transferred to the Regional spinal unit for further treatment. One 17-year-old patient had bilateral open distal radii fractures that required open reduction and plate fixation with a second procedure to debride his wounds (Images 1 and 2). Table 1 summarises each patients' injuries (Image 3).

4. Discussion

It is well documented that motocross is a high-risk sport and the frequency of patients presenting with injuries to orthopaedic surgeons confirms this. Studies show an injury rate of 9.6% per motocross event.¹ These injuries occurred despite 92% of riders wearing full protective gear. This risk is over 5 times greater than that of road cycling.²

The age of participants ranges from children as young as 4-year-old to those in their 50's. Up to 23% of injuries occur under the age of 15 years³ and may account for 7% of all paediatric trauma.⁴

There is a 2% mortality rate associated with trauma as a result of off road motorbikes.³ Despite wearing helmets participants can expect a head injury in 6–9% of injuries.^{1,3}

80% of injuries occur at speeds below 50 km/h and nearly half as a consequence of being thrown over the handlebars.¹

Soft tissue injuries with contusions and laceration account for 57% of injuries.² This group also includes significant soft tissue wounds some requiring surgical debridement.

Fractures constitute 27% of all injuries with the majority involving the upper and lower limbs.²

Distal radius and wrist fractures are common. Tibia fractures and foot & ankle fractures account for most of the lower limb fractures. 6% involve the spine and 31% of these result in paraplegia or tetraplegia.²

Of the ligamentous injuries shoulder dislocations, ACJ disruptions, ACL and other knee ligament injuries are

Image 1 – A 17 year-old male with bilateral open distal radius fractures (Left).

common. 35% of all knee injuries require later reconstructive surgery.²

In a study of 299 paediatric motocross injuries, Larson et al reported that 95% of injuries required orthopaedic treatment with 28.5% of these requiring surgery.⁵ Similarly the majority of their patients were male (94%) with an average age of 14.1 yr (range 5.4–17.9 yr) and hospitalised patients required on average 3 days in a hospital bed. The majority of fractures occurred in the hand, forearm, clavicle, femur and tibia. Of the 55 head injuries sustained, 54 were wearing protective helmets at the time of injury, 36 needed hospital admission for observation, 8 had an abnormal GCS with 5 of these sustaining some degree of brain injury.

Our study reports the injuries sustained from a single motocross event. Limitations of this study include that it is a retrospective study. It was not possible to determine the cost of treatment. It is difficult to extrapolate these results to a broader analysis of the epidemiology of injuries sustained from this sport, but these rates of injury are comparable to reports from larger studies. It is also possible that some injuries were not included if the patients self presented to a different hospital or attended the local private hospital from which data was not obtained. Course design or poor conditions could have contributed to higher than expected injury rates. Regardless, this report highlights the high injury rates

that can be expected when one of these events ‘comes to town’. These injuries are often in the paediatric population and concern remains that these children are being allowed to participate in an activity that is too high risk. Some would argue that a proportion of children do not have the level of maturity or the required dexterity and coordination needed to safely operate these motorbikes.⁶ Tougher regulations on the age of participants, their skill level and the protective clothing required may help reduce injuries in this paediatric population. Further research is needed to identify which safety measures will help reduce the number and severity of injuries. Additionally, although these 14 patients do not seem very significant for a department dealing with 150 cases in 2 days, these patients often require extensive input from multiple services including, emergency staff, radiographers, ambulances, specialists and emergency theatre time. This increase in trauma occurring in a relatively short period of time in addition to dealing with the ‘normal’ levels of trauma and acute patients can overwhelm many emergency departments. This seems unnecessary given that these occasions are relatively few and predictable. The additional 12 h of operating time required to deal with their injuries resulted in prolonged waiting times for theatre or emergency department assessment for other patients with a potential reduction in the level of healthcare received. The organisers of this event routinely

Image 2 – A 17 year-old male with bilateral open distal radius fractures (Right).

Table 1 – Summary of patient's age, sex and the injuries they sustained, including the procedures performed and the duration of hospital stay.

Patient	Age	Sex	Injuries summary	Procedure	Length of stay/days
1	21	M	Left femur fracture	Intramedullary nail	3
2	20	M	Head injury with LOC and amnesia C7 spinous process fractures Anterior wedge compression fractures T3–T6		Transferred to Neurosurgical Unit
3	11	M	Head injury with LOC and amnesia		1
4	37	M	Contusions right hip Abrasions right foot		0
5	18	M	Laceration and partial triceps tendon injury	Wound debridement and tendon repair (2 procedures)	2
6	41	M	Open 5th Metacarpal fracture		3
7	14	M	Right distal radius fracture Right scaphoid fracture Right ulna nerve neuropraxia	Internal fixation of distal radius and scaphoid	4
8	27	M	Laceration left hand	Wound debridement	0
9	13	M	Grade 2 ACJ injury		0
10	17	M	Bilateral distal radii fractures	Internal fixation both wrists Wound debridement (2nd procedure)	7
11	20	M	Left clavicle fracture Left thigh contusion		1
12	16	M	Left wrist sprain		0
13	19	M	Laceration right hand		0
14	24	M	Left hip contusion		0

arrange onsite medical care and inform local hospitals of a forthcoming competition. Without appropriate planning by increasing emergency and theatre staff we can expect this scenario to be repeated.

Image 3 – A 21-year-old with closed femoral shaft fracture.

5. Summary

Motocross is a popular sport and at times has unacceptable risks of injury in organised competitions, especially with regards to paediatric injuries. Better course design, restrictions on participant age and limitations in vehicle speeds may help reduce the number of severe injuries. These events can also generate a sudden trauma burden to local hospital facilities with knock on effects on waiting times for theatre and potentially compromising not only treatment of the injured participants but also the treatment of other patients in the hospital. Cooperation with event organisers may enable extra staff and theatre time to be arranged in advance but at increased cost to the local health services.

Conflicts of interest

All authors have none to declare.

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