BRIEF REPORT

Injury and Illness in Mountain Bicycle Stage Racing: Experience from the Trans-Sylvania Mountain Bike Epic Race

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Objective.—The popularity of mountain bicycle (MTB) riding has increased significantly since its inception in the 1970s, as have injuries from MTB riding. As MTB stage racing is a relatively new segment of MTB racing, the purpose of this study was to evaluate the injury and illness patterns associated with MTB stage racing to assist future medical providers in covering events.

Methods.—The Trans-Sylvania Mountain Bike Epic Race consisted of 7 stages. An onsite medical team of physicians, nurses, and paramedics provided medical coverage. The providers logged each medical encounter on a medical form. The log included the location where the treatment was provided (on course, at the finish or after the race), a description of the injury/illness, treatment that was rendered, the supplies needed for treatment, and the disposition of the patient (continue, withdraw but continue the next day, withdraw, or transfer to the hospital).

Results.—A total of 52 athletes competed in the inaugural edition of the race. There were 30 separate medical encounters, with a total of 34 injuries/illnesses. Of these, 22 (65%) were classified as injury, and 12 (35%) were classified as illness. Four athletes withdrew from the race, 1 from injury and 3 from illness. Skin and soft tissue injuries/illnesses were the most prevalent.

Conclusions.—Injury and illness patterns of MTB stage racing are similar to those of other wilderness sporting events and prior data on MTB-related injuries. Minor skin, soft tissue, and orthopedic injuries are the most common. Illness accounts for the majority of withdrawals.

Key words: wilderness, environmental illness, wounds and injuries, sport medicine, emergency medicine

Introduction

The popularity of mountain bicycle (MTB) riding and racing has increased significantly since its inception in the 1970s, as have reported injuries from MTB riding. As a relatively new segment of MTB racing, MTB stage racing has increased in popularity in recent years. Modeled after the traditional road bicycle stage racing, these races may extend from several stages over a couple days to a full week or longer of racing. Races have numerous stages focused on the various disciplines unique to MTB racing. They can include smooth road, gravel road, and

single-track trails with climbing and descents. These stage races will often include varying stages, including time trials, cross-country racing, and downhill/technically focused stages.

Medical coverage of MTB stage racing requires specialized focus because these races are often held in remote areas with limited access to definitive care and single-track trails extend over great distances, limiting access to injured athletes. Several studies have been published looking at injury patterns associated with MTB riding, but these have not focused on patterns associated with multiday stage racing.^{1–4} There are numerous studies looking at injury patterns and medical requirements in multiday wilderness sports events that usually focus on multiday adventure racing, a sport that often includes MTB segments.^{5,6} From this experience, recommendations have been made for medical coverage of extreme wilderness and cycling related events based

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on injury patterns at these events.^{7,8} These recommendations were used as guidelines in preparing for the medical coverage of a unique multistage MTB event.

As the medical providers for the Trans-Sylvania Mountain Bike Epic Race, the purpose of this study was to evaluate the injury and illness patterns associated with MTB stage racing, with the hypothesis that these patterns are similar to multiday wilderness adventure racing owing to the similar nature of both the activity and the environment as well as single-event MTB racing. Information gained from this research could then be used to help medical care providers better prepare for future MTB stage races.

Methods

The Trans-Sylvania Mountain Bike Epic Race, held May 30 to June 5, 2010, consisted of 7 separate MTB stages, with athletes competing for individual stage wins as well as the general classification victory (accumulated time over the course of the race). Stages varied in complexity from a 10-mile time trial to a 47-mile mass start cross-country race that included more than 7000 feet of climbing (Table 1). An onsite medical team of physicians, nurses, and paramedics provided medical coverage throughout the race week, both during the race stages as well as after the race.

The race facilities headquarters, where racers and staff camped throughout race week, had a small cabin that was used for medical care, with 2 AEDs on site. All other medical supplies were obtained or supplied by the race medical director. The medical supplies included wound care supplies, orthopedic supplies, medications, and intravenous fluids (normal saline, tubing, and start kits). The wound care supplies ranged from simple dressings and bandages to all supplies needed for complex laceration repair as well as supplies for ocular trauma. The orthopedic equipment included wraps, splinting supplies,

and equipment to stabilize or immobilize patients requiring extrication. The onsite medications included acetaminophen, ibuprofen, lomolil, ondansetron, antacids, diphenhydramine, albuterol, epinephrine, and lidocaine. Land lines were available for phone communication at the campsite, but on-course communication was limited to cellular phones.

The medical plan provided for initial evaluation by the race medical team, on-site stabilization, and either definitive treatment or stabilization until arrangements were made for transfer to the nearest hospital. The medical team was composed of physicians, nurses, and paramedics, with members volunteering for anything from 1 stage to the entire race week. All medical encounters were reviewed with the medical director. Any follow-up care needed during the race was done at the campsite. Any patient requiring more definitive care than could be provided on course or at the camp was to be transferred to the closest surrounding hospital, by either private car or emergency medical services depending on patient stability.

During the race, aid stations and checkpoints were set up at various places along the course. These aid stations were placed at locations that were both accessible by vehicle and thought to be strategically helpful to racers. Each race stage had 0, 1, or 2 aid station/checkpoints, depending on the length of the race stage. Each aid station was manned by race volunteers who were handing out water, sports drinks, and food. In addition, there were race staff present to record racers as they passed through each aid station/checkpoint to ensure all racers were accounted for as the race progressed. A small contingent of the medical staff was also placed at each aid station to provide on-course medical support. Attempts were made to ensure a range of provider levels at each medical station whenever possible. A similar station, including medical support, was set up at the finish line to provide any needed support to racers as they completed each stage. Throughout the race, 1 physician also traveled with 1 of the race directors in a motorized vehicle. That allowed the race director, who had thorough knowledge of the course, to get a physician as close as possible to an injured athlete. After the race, injuries and illnesses were treated at the camp unless transfer for more definitive treatment was necessary.

The various providers logged each medical encounter on a medical form. The form included the location where treatment was provided (on course, at the finish, or post-race), a brief description of the injury/illness, treatment that was rendered, the medical supplies needed to provide treatment, and the disposition of the patient (continue racing, withdraw but continue the next day, or withdraw completely and transfer to the hospital). If patients had multiple injuries at evaluation, then all injuries were recorded on the same form. If a patient presented at separate times for

Table 1. Trans-Sylvania Mountain Bike Epic Course

<i>Stage number</i>	<i>Distance, miles</i>	<i>Altitude change, feet</i>
Stage 1 prologue time trial	10	1400
Stage 2 cross country	42.5	5300
Stage 3 cross country	45	5100
Stage 4 cross country	47	7000
Stage 5 mini XC/super D ^a	28	2200
Stage 6 cross country	38	5300
Stage 7 cross country	23	3360

^a Stage 5 consisted of 4 timed sections within the stage, with athletes regrouping and riding together in neutral sections between each timed section.

treatment of the same injury, each encounter was recorded separately. The data from the medical forms were transferred to a medical log. The medical log was then used to evaluate the incidence of injuries and illness encountered throughout the race, using Microsoft Excel software (Microsoft, Redmond, WA). This study received approval from the Institutional Review Board of Drexel University College of Medicine.

Results

There were 30 separate medical encounters, for a total of 34 injuries/illnesses. Of these, 22 (65%) were classified as injury (Table 2) and 12 (35%) classified as illness (Table 3). Overall, skin and soft tissue injuries and illness accounted for nearly half of the medical encounters (47%).

The majority of injuries were classified as skin and soft tissue injuries, with abrasions being the most prevalent, and comprised 32% of the injuries seen. Other skin and soft tissue injuries evaluated or treated included blister care (14% of injuries), contusions (14% of injuries), and 2 lacerations (9% of injuries). Five wrist injuries were treated (23% of injuries) and accounted for all of the orthopedic injuries. In addition, 1 athlete was treated for mud and debris in the eyes. Another athlete was treated for hymenoptera envenomation; this patient was not in anaphylaxis and received local wound care.

The majority of illnesses seen were equally split between gastrointestinal illness, asthma exacerbations, and headaches, each accounting for one quarter of the illness treated. The remaining quarter of illness treated consisted of 2 cases of dehydration and 1 case of dermatitis. The gastrointestinal illness cases consisted of 1 patient with vomiting, 1 with diarrhea, and 1 with both vomiting and diarrhea symptoms.

Four athletes withdrew from the race as a result of their injury/illness. One of the 4 withdrawals was clas-

Table 2. Type and frequency of injuries in the Trans-Sylvania Mountain Bike Epic 2010

<i>Type of injury</i>	<i>Number of injuries (n = 22)</i>	<i>Percentage of cases</i>
Skin and soft tissue	15	68%
Abrasion	7	32%
Blister	3	14%
Contusion	3	14%
Laceration	2	9%
Orthopedic, all wrist injuries	5	23%
Ophthalmologic, FB/mud in eyes	1	4.5%
Environmental, hymenoptera sting	1	4.5%

Table 3. Type and frequency of illnesses in the Trans-Sylvania Mountain Bike Epic 2010

<i>Type of illness</i>	<i>Number of illnesses (n = 12)</i>	<i>Percentage of cases</i>
Gastrointestinal	3	25.0%
Vomiting and diarrhea	1	8.3%
Vomiting	1	8.3%
Diarrhea	1	8.3%
Respiratory, asthma	3	25.0%
Neurologic, headache	3	25.0%
Dehydration	2	17.0%
Skin and soft tissue, dermatitis	1	8.3%

sified as an injury, an athlete who sustained a laceration to the elbow requiring suturing in the medical cabin on site. This patient elected not to start the following day's stage. The 3 remaining withdrawals were the result of illness: 2 athletes with dehydration and 1 athlete with vomiting and diarrhea. Two of these athletes needed treatment at the nearest emergency department. One of these was transferred to the hospital at the discretion of the race medical staff for persistent vomiting and diarrhea despite intravenous fluids given at the race site. The other was a self-referral, treated for dehydration, who notified race staff afterward. Both athletes were subsequently discharged from the emergency department after further treatment and without hospital admission.

Discussion

The findings of our study correlate well with prior studies of endurance-related wilderness sporting events and prior data on MTB-related injuries. We found that approximately two thirds of medical encounters were injuries, with skin and soft tissue injuries being the most prevalent injury seen. This finding correlates well with what Townes et al⁵ and McLaughlin et al⁶ found in multiday adventure racing. In a study of single-event MTB injuries in 1996, Kronisch et al⁴ also found skin and soft tissue injuries to account for the majority of MTB-related injuries.

The other one third of medical encounters consisted of illnesses. It is interesting to note that the majority of withdrawals were a result of illness as opposed to injury. This pattern of withdrawal caused primarily by illness rather than injury has also been observed in multiday adventure racing.^{5,6} Half of the withdrawals were a result of gastrointestinal illness, which may or may not have been related to the race itself.

It is also interesting to note that all of the orthopedic injuries observed were in the upper extremities. A preponderance of upper extremity injuries has been seen in some prior studies of MTB injuries as well.^{9,10} Falling forward on a mountain bike may explain this increased likelihood for upper extremity injuries as opposed to lower extremity injuries. The upper extremities are freely moving away from the body during a forward fall and are more susceptible to injury from a number of outside forces. Falls to the side have been shown to cause lower extremity injuries.^{3,9} In our study, however, repetitive stress to the wrists resulting in an overuse injury provides an interesting area of focus in addition to the pattern of falls. One of the athletes presented with wrist complaints on 2 separate occasions but did not report having fallen. He was among the few athletes racing without a front suspension fork that would have decreased the vibration and shock absorbed in his wrists. Overuse injury patterns are an understudied area of MTB racing, and more research in this area may shed light on associations between equipment and injury, and lead to the development of safer equipment.

Although head and neck injuries have been reported, particularly with forward falls in MTB riding and racing, we were fortunate not to encounter any of these injuries.^{1,3} However, the medical staff was equipped to immobilize and extricate a patient if needed. The racers were required to wear approved helmets at all times, which may have helped to prevent some of these injuries.

While the injuries seen can be explained from events in the race such as falling, the illnesses were not all necessarily a direct result of the race itself. Dehydration, dermatitis from exposure, and asthma exacerbations while cycling are illnesses that can be attributed to the event. That is not the case with gastrointestinal illnesses and headaches, which may or may not have been caused by the race conditions. This finding indicates that the medical staff for an event like this needs to be prepared to care for general medical issues that may arise during the event but may not be a result of the event.

This was a pilot study performed during the inaugural year of a multiday MTB stage race. Future goals are to continue to observe the incidence of injury and illness patterns involving this unique race environment and comment on relevant associations discovered. Several potential areas of further focus include injury patterns early versus late in the race, the rider demographics and skill level associated with injuries and illness, and environmental factors influencing injury and illness patterns during the race. In addition, as the race expands in size, further review of the overall injury and illness patterns from year to year can be done to validate our findings from this initial race.

STUDY LIMITATIONS

The small number of athletes racing limits this study, as only a small number of encounters were observed. It is possible that the medical staff may not have accounted for several injuries or illnesses as they were not reported.

Conclusions

We found that minor skin and soft tissue injuries and minor orthopedic injuries comprised the bulk of medical encounters seen in this event. Medical illness forced the majority of race withdrawals. Medical directors of multiple-day MTB races can use this information to help prepare for future medical coverage of similar events.

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