CASE REPORT

Corneal Opacity in a Participant of a 161-km Mountain Bike Race at High Altitude

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Visual dysfunction is a relatively uncommon complaint among athletes during ultraendurance races. The pathophysiology of most of these cases is unknown. Corneal opacity has been speculated as the etiology for most of reported cases. We are presenting a case of a 56-year-old man with a partial unilateral corneal opacity and edema at kilometer 150 of a 161-km mountain bike race in high altitude. He was not able to finish the race (12-hour cutoff) because of his visual symptoms. He completely recovered in 3 days with no sequelae.

Key words: blurred vision, corneal edema, ultraendurance

Introduction

Visual disturbance is an uncommon occurrence among individuals during ultraendurance events.¹ One study showed that approximately 3% of runners experienced vision problems severe enough to impact race performance during 161-km ultramarathons.² According to one study, most of these athletes report painless blurry vision and cloudiness.³ The underlying etiology is still unknown, but it may be related to corneal edema. We are presenting a case of a 161-km mountain biker with corneal edema.

Case Report

A 56-year-old man experienced blurry vision in his left eye at kilometer 150 of the Leadville 100 (mile) race in August 2014. This is a 161-km mountain bike race in Leadville, CO, with course altitude ranging from 2804 m to 3840 m.⁴ The race takes place on mostly closed dirt roads, single track, and pavement. High-speed descents of greater than 60 km/h on dirt are not uncommon, and flying debris is more common during dry races.

The 2014 race conditions were very fast, dry, and dusty. Race temperature at the start (6:30 AM) was 1°C with a light wind. The temperature rose to approximately

17°C and the wind reached approximately 30 km/h by midday. The race day was dry with no precipitation and average humidity of 58% (range, 27% to 89%). His acclimatization training for the event included weekend training rides up to 4300 m peaks from his home in Denver (approximately 1600 m). He had applied a new aerosol sunscreen before the start of the race to his arms and legs and may have inadvertently exposed his eyes to the sunscreen. He reported having slid on a sandy technical section at slow speed (<16 km/h) during the early stage of the race, which caused his sunglasses to come off, and he thought loose dirt entered his left eye. He then raced uneventfully until kilometer 150, when at the last aid station his left eye vision became clouded. He had no pain or excessive tearing. Because of his visual disturbance, he was asked to take himself out of the race and seek medical attention at the finish line medical tent.

He had completed this race many times in the past and never had similar symptoms. He reported an ophthalmologic history significant for bilateral giant papillary conjunctivitis (1996), bilateral corneal keratosis (1997), and bilateral myopia and astigmatism. He had been prescribed hard contact lens to correct his astigmatism but had not worn them for more than a year. His medications were lithium carbonate, aripiprazole, and modafinil. The lithium carbonate and aripiprazole were held for 2 days before the race per his psychiatrist. Otherwise, his pertinent past, medical, and surgical histories were unremarkable.

At the medical tent his vital signs including pulse rate, pulse oximetry, and blood pressure were within normal

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Figure 1. Left medial corneal opacity at the finish line of a 161-km mountain bike race.

limits. On physical examination he had a corneal opacity in the nasal aspect of his left eye (Figures 1 and 3). No conjunctival injection, foreign objects, or any other abnormality was identified. His right eye visual field (confrontation test) and acuity (3-m “counting finger” and “hand motion”) were normal. However, his left eye examination revealed decreased acuity with blurry vision mainly in the nasal field. He was unable to accurately count fingers, but he was able to detect hand motion. We were not able to evaluate his visual depth perception as his left eye vision was compromised. He was advised to rest and follow up with an ophthalmologist if his symptoms worsened.

The opacity cleared subjectively per his report by almost 25% during the first 6 hours after the event and by approximately 90% 2 days later (Figures 2 and 3). He decreased exposure to bright light by wearing mirrored sunglasses while outside and inside the home while watching any TV, computer, or mobile screens. He was originally scheduled for a follow-up appointment with an ophthalmologist 4 days after the race, but because of the resolution of his symptoms over the course of 3 days, he canceled the appointment. Subjectively, he was fully recovered without further complications.

The following year, he had successfully finished the race wearing mirrored sunglasses with restraints. Mirrored sunglasses have a reflective optical coating on the outside of the lenses that decreases the amount of light, including the UV light, passing through the tinted lens. Mirrored sunglasses are especially useful for environments with extra UV light exposure such as water, snow, and higher altitudes.

Discussion

Visual dysfunction among ultraendurance athletes is an uncommon condition.² The etiology in most cases is unknown. However, based on limited self-report studies, a transient corneal edema is the likely pathologic cause.^{1,3} Most athletes report painless blurred vision as the main complaint.^{1,3,5} Cases of partial or unilateral corneal edema are not common.^{5,6} However, the exact incidence of unilateral or bilateral corneal edema among ultraendurance athletes is unknown.

There are many possible etiologies for corneal edema among ultraendurance athletes. In general, corneal edema can be a result of an acute or chronic trauma,

chemical exposure, inflammatory process, and hypoxia.⁷ Exposure to high altitude racing conditions brings with it inherent challenges of dehydration, excessive sun exposure, low oxygen tensions, cold, wind, and low barometric pressure.^{8–10} It is a well-known phenomenon that central corneal thickness increases in extremely high altitude (>6000 m).^{9–14} The corneal thickness seems to be a result of hypoxia, causing corneal metabolism dysfunction that leads to stromal edema.^{8–10} Refractive eye surgery may be adversely affected by high altitude, wind, and excessive exposure to sunlight and UV radiation.^{3,8,14} UV light intensity is enhanced at altitude, and the likelihood of trauma to corneal tissue is enhanced by airborne flying debris along dirt roads where high altitude endurance events are held. Impurities in the air caused by flying dust particles and strong winds can traumatize already sensitive tissues. Chemical administration through aerosol and pump-action sunscreen canisters are becoming ubiquitous and a potential source of eye problems as sweat may inadvertently drip down into the eyes of racers, causing ocular problems and corneal irritation in particular. Visual field loss thus becomes a major problem for those engaged in high altitude cycle sports-racing in which mountain and road bike racing speeds can exceed speeds of 100 km/h. Although hard contact lenses are more often associated with corneal disease, soft contact lenses too may confer increased risk of corneal edema and opacity under racing conditions of heat, dirt, sun, and wind exposure. Corrective lenses with UV protection in a wraparound style are the preferred eyewear for racing at high altitudes.

In a case series of 3 patients, amantadine was reported to cause corneal edema.¹⁵ Some psychotropic agents in rare cases can cause blurred vision; however, this happens often during the acute phase of treatment with high serum level and as a bilateral condition with no report of actual corneal edema.¹⁶

Absence of pain in this case helped distinguish corneal edema from a corneal abrasion. We believe that the cause of this cyclist's corneal edema was multifactorial, including chemical (aerosol sunscreen) exposure, dry, dusty, and warm environment, and high altitude. It is important to assess the athlete for dehydration, mental status, and ability to continue any specific race. Corneal edema among ultraendurance athletes typically resolves

Figure 2. Improvement of the left medial corneal opacity 2 days after the race.

Figure 3. Magnification of left eye image in Figures 1 and 2.

without intervention within a few hours.^{1–3,13} Some athletes have been able to prevent recurrence of the visual dysfunction with protective eyeglasses and hydration lubricant eye drops.¹

Visual dysfunction can be so severe that athletes are unable to complete the race, as in this case. The risks vs benefits of racing with even a modicum of lost peripheral vision or depth perception need to be taken seriously during high altitude sporting events. Even minor visual dysfunction increases accident risks. As such, vision impairment that compromises safety is cause for the athlete to discontinue the competition, at least until adequate vision is restored. Low-level light poses an increased hazard for those with corneal edema and should be taken into consideration when determining whether or not it is advisable for an athlete to continue racing. Based on the reported natural course of endurance exercise-related corneal edema, if symptoms worsen or fail to resolve within 24 hours, full ophthalmologic examination is warranted.^{3,6}

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