

SPORTS-RELATED INJURIES AMONG ATHLETES COMPETING AT THE MALAYSIA ULTRA-DISTANCE TRIATHLON EVENT

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Abstract

Background: The rise in global popularity of triathlon competition requires the medical team to be familiar with various endurance sport related injuries that may sustain throughout the race period. However, there have been very few published studies on the injury profiles of triathlon events held locally.

Objective: To describe the injury rate, the pattern of injuries, and time of presentation for medical treatment among injured athletes at the ultra-distance triathlon event held in Malaysia in year 2014.

Methodology: This cross-sectional study analysed data from all athletes who sustained the injury that required treatment or assessment by the medical personnel during or immediately after the triathlon race. Data on injured athletes were retrieved from Medical Encounter Form used during the race. All physical injuries were documented based on body part affected, type of injury sustained and time of medical treatment sought.

Results: Approximately 30.7% (329/1073) of the athletes in our study population presented to the medical team for treatment during or immediately after the event, with 539 injuries identified among them. Injuries were more commonly seen among male, age group of 30–39 years old, and Asian athletes. The injuries more commonly sustained during the running discipline. Muscle cramps, sprains, and nausea and/or vomiting were the most common type of injury across all race disciplines. There was an apparent increased in athlete presentation from 15:00 hours, and it remained high until 23:00 hours.

Conclusion: There was a wide range of injuries encountered by the competitors. Our results will add to the growing body of knowledge on local triathlon injuries and helps the medical team preparation for future triathlon events.

Keywords: *Athlete, injury, physical endurance, sport, triathlon*

Introduction

The triathlon sport has gained tremendous interest from athletes after making its first appearance as an Olympic sport at the 2000 Sydney Olympic Games.¹ Today, there are over 160 national federations worldwide affiliated with the International Triathlon Union (ITU).² The triathlon comprises three consecutive disciplines: swimming, cycling and running. Race distances vary, from the shortest 'Sprint distance triathlon' to the 'Ultra-distance triathlon', which consists of a 3.86-km swimming stage, cycling for 180.25 km, and ends with a 42.2 km running stage.³ With more and more athletes competing in triathlon races of various distances, attending medical teams are seeing a wide range of injuries during such events.

Many studies have presented an analysis of sport-related injuries related to the triathlon events.³⁻⁶ Overuse injuries are the most common injury sustained by triathletes,⁴ with approximately three times as many athletes affected by overuse injuries during training as are affected by acute injuries. About 38% of injuries in Ultra-distance triathlons are related to muscle cramps, and dehydration.⁶ Running is the most commonly reported action associated with overuse injuries among triathletes, followed by cycling and swimming.³ In addition to injuries, other common illnesses faced when engaging in such endurance sports are hypothermia owing

to water temperature or hyperthermia secondary to the use of wetsuits during the swimming stage. Several cases of marine life envenomation, such as from jellyfish stings, have also been reported.^{7,8}

As in other regions of the world, there has been increasing interest in triathlon events among Asian athletes. In an independent report by Roethenbaugh on global triathlon participation, approximately 460,000 triathletes were active in Asian regions during 2013.⁹ The same report also estimated that 660 triathlon events of various distances were conducted in Asia during the same year. The rise in global popularity of this triathlon competition requires the medical team to be familiar with various endurance sport-related injuries that may be sustained throughout the race period. Data analysis from the event will serve as a reference for establishing medical emergency plans and preventive strategies for future races. However, there have been very few published studies on the injury profiles of triathlon events held in Asia as well as in Malaysia. The lack of this information has prompted us to evaluate the injury rate, the pattern of injuries, and time of presentation for medical treatment among injured athletes at the ultra-distance triathlon event held in Malaysia.

Methods

Study design and setting

This cross-sectional study was conducted using data of all athletes competing in the Malaysia International Triathlon Race event in year 2014, held at Langkawi island. This triathlon race applied the ultra-distance standard. The race begins with an ocean swim of 3.86 km, starting from a jetty platform. The athletes then enter a transition zone, where they don helmets, cycling shoes, and a race number. They may choose to remain in their swimsuits, tri-suits, or change into cycling shorts. The athletes then mount their bicycles and head out onto the two-loop cycling course through rolling hills for a distance of 180.25 km. Once competitors return to the transition zone, they change into running shoes and begin the 42.2 km running stage before returning to cross the finish line. The weather during the race was dry with seawater temperatures ranging from 27–29°C, average humidity of 86%, and air temperatures of 28–31°C.¹⁰

Participants

The study population comprised all athletes who sustained injury attended by the medical team. For this study, injury and illness were defined as any physical complaint experienced or suffered by an athlete that required treatment or assessment by medical staff during or immediately after the triathlon race.¹¹ By collecting medical attention-type data, we hoped to capture all injuries

presented to the medical team, to project the actual burden of injury during this sports event. All injured athletes were attended by trained medical personnel from a single medical team. The team was headed by the state senior emergency physician and comprised emergency physicians, medical officers, medical assistants, and staff nurses. Six medical aid stations were set up at several locations along the race course, to cater to the medical needs of the triathletes during the event. A main medical tent was set up near the finish line as a medical observation area for any athlete requiring special treatment.

Information on athletes' demographic and injuries sustained was retrieved from the medical encounter form. This form was created based on previous local emergency medicine teams' experience in managing sports injuries. This form contained the important aspect of injured athletes that seek medical attention such as athlete race number, age, gender, country of origin, race discipline when the injury encountered, and time when the medical treatment sought. Injuries were described according to the affected body part, and type of injury sustained. This form filled up by the attending medical personnel who attended the injured athlete.

Data Analysis

All data were computed and analysed using IBM SPSS Statistics for Windows Version 20.0 (IBM Corp., Armonk, NY, USA). Data are presented as numbers and proportion for categorical

variables. Numerical variables, such as participants' age, are presented as a median and interquartile range (IQR). The injury rate per presentation was obtained by dividing the total number of injuries with the total number of injured athletes who presented to the medical team. The distribution of injuries is shown according to the affected body part and type of injury, in percentages. Time slots during which athletes sought medical treatment are presented in a bar chart.

Ethical Approval

The study was conducted in compliance with ethical principles outlined in the Declaration of Helsinki and Malaysian Good Clinical Practice Guideline. This study was approved by the Medical Research and Ethics Committee, Ministry of Health Malaysia (NMRR-14-1258-22858).

Results

Injured athlete characteristics

Of 1073 athletes competing in this triathlon race, 329 (30.7%) athletes presented to the medical team for treatment during or immediately after the event. Table 1 summarises the demographic characteristics of the injured athletes. The median age of injured athletes was 38 years old, with the youngest athlete sustained an injury in the race was 20 years old, and the oldest was 68 years old. The athletes aged 30–39 years showed a high percentage of injury (n=145, 44.1%). Male athletes dominated the injury list (88.7%). More than 75% of injured competitors were Asian, and only a small proportion of athletes came from African countries (1.8%).

Injuries sustained by athletes

A total of 539 injuries identified among 329 injured athletes. Thus, the injury rate for this race event was 1.64 injuries per presentation. Of these, 210 athletes (63.8%) sought medical assistance at least once. Two athletes were found seeking

Table 1. Demographic characteristics of injured athletes, $N=329$.

Variables	<i>n</i>	(%)
Age (years), median (IQR)	38	(10)
Age Group (years)		
20-29	42	(12.8)
30-39	145	(44.1)
40-49	119	(36.2)
50-59	18	(5.5)
>60	5	(1.5)
Gender		
Male	294	(89.4)
Female	35	(10.6)
Regions		
Asia	251	(76.3)
America	11	(3.3)
Africa	6	(1.8)
Europe	37	(11.2)
Oceania	24	(7.3)

n = Frequency; % = Percentage; IQR = Interquartile range

Table 2. Distribution of injuries by affected body part and type of injury according to the race stages.

Variables	Race Stages		
	Swimming <i>n</i> (%)	Cycling <i>n</i> (%)	Running <i>n</i> (%)
Body part affected			
Head and Neck	0	0	17 (4.5)
Trunk	1 (5.9)	3 (13.6)	36 (9.6)
Pelvis / Groin	0	0	15 (4.0)
Upper Limbs	2 (11.8)	1 (4.5)	7 (1.9)
Lower Limbs	14 (82.3)	12 (54.5)	202 (54.0)
Back	0	0	81 (21.7)
Others ^a	0	6 (27.3)	16 (4.3)
Total	17 (100)	22 (100)	374 (100)
Type of injury			
Muscle cramps	3 (15)	9 (23.1)	372 (77.5)
Sprain	1 (5)	15 (38.5)	22 (4.6)
Nausea ± Vomiting	0	4 (10.3)	16 (3.3)
Dehydration	0	2 (5.1)	14 (2.9)
Jellyfish Sting	16 (80)	0	0
Overexertion	0	1 (2.6)	14 (2.9)
Headache	0	0	11 (2.3)
Giddiness	0	0	10 (2.1)
Abrasion / Contusion	0	3 (7.7)	6 (1.3)
Blister	0	2 (5.1)	5 (1.0)
Hyperthermia	0	1 (2.6)	1 (0.2)
Hyponatremia	0	2 (5.1)	0
Hypotension	0	0	2 (0.4)
Diarrhoea	0	0	1 (0.2)
Abdominal pain	0	0	1 (0.2)
Others ^b	0	0	5 (1.0)
Total	20 (100)	39 (100)	480 (100)

n = Frequency; % = Percentage

a = other body part affected including eyes and systemic injury.

b = other injuries including foreign body in the eyes, conjunctivitis, gastroesophageal reflux.

medical treatment for six times during the entire race. Most injuries occurred during the running stage (89.4%), followed by the cycling and swimming stages, with 6.8% and 3.8%, respectively. Lower limbs were the most commonly affected part of the body in all three race segments, with 54.0% occurring during the running portion of the event. Upper limbs were the least affected, as reported to the medical team (Table 2). Muscle cramps were the most prevalent type of injury across all race stages, reported by three, nine and 372 athletes during the swimming, cycling, and running stage of the triathlon, respectively. Sprains were the second most common injury (38 cases), followed by nausea and/or vomiting (20 cases), and dehydration (16 cases). In the swimming stage, almost all reported injuries were caused by jellyfish stings (80.0%). A few athletes also suffered from diarrhoea and abdominal pain. Most athletes received medical treatment at the event site. Only seven

athletes were brought to a nearby hospital for further care and were later discharged uneventfully from the hospital.

Time of presentation for medical treatment

The triathlon event started approximately at 08:00 hours. Information regarding the time slots during which athletes presented for medical treatment is depicted in Figure 1. No athletes were injured during the first hour of the race. Subsequently, there was an increased in athlete presentation after 15:00 hours, and this remained high until approximately 23:00 hours. It can be seen from the bar graph that the most substantial proportion of athletes (n=122) sought medical assistance during the period from 18:00 to 18:59 hours. Medical treatment was received by four athletes after 00:00 hours. The last athlete seen by the medical personnel was at 00:40 hours of the following day.

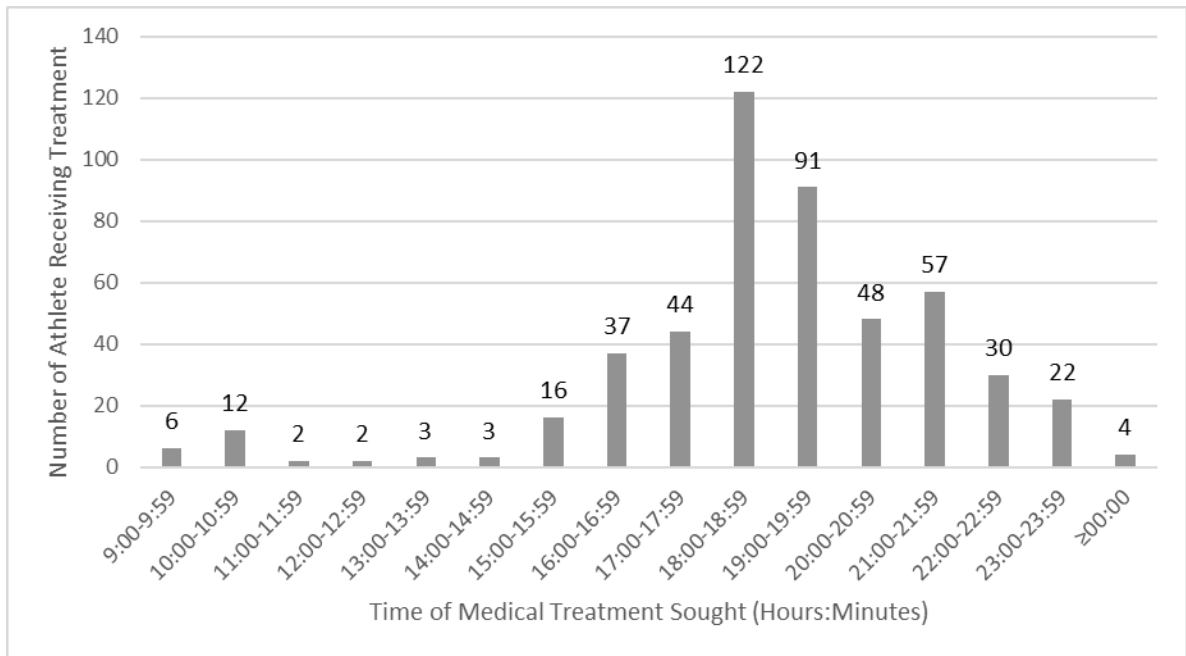


Figure 1. Distribution of medical contact, by time of the race day.

Discussion

To the authors' best knowledge, this is the first analysis of sports-related injury among athletes participating in a triathlon event in Malaysia. Only a few countries in Asia have had the opportunity to host an ultra-distance triathlon event. Since temperature and humidity during the event influenced athlete performance,^{12,13} the results of this study could be used as a basis for understanding the patterns of injury

among athletes competing in such triathlons held in Asian countries, especially those with temperature and humidity similar to Malaysia. Furthermore, the diagnoses of injuries reported during this triathlon event were confirmed by the trained medical personnel on site, which would reduce any discrepancies in the study results as opposed to the information based on athletes' interpretation of their injuries.

The demographic data of the current study showed that male and

middle-aged competitors most commonly sought medical treatment during the 2014 event. The majority of athletes were from Asian regions, and we observed a high percentage of injuries sustained by this group of athletes. The incidence of injury among triathletes in ultra-distance races has been reported previously.^{4,14,15} By comparison, the injury rate of 1.64 in this study was higher than that reported by Rimmer and Coniglione.¹⁴ In the study of participants at the ultra-distance Redman Triathlon held in 2010, the injury rate was found to be 1.37 injuries per presentation. However, the prevalence of athletes who received medical treatment in the current study was lower compared with the Redman Triathlon cohort (30.7% vs 37.7%). The higher injury rate coupled with lower prevalence indicates that fewer athletes suffered injuries during the present race, but competitors sought assistance from the medical team multiple times throughout the race. The reason for seeking medical treatment more than once is unknown, and this is an area of interest for future study.

There were 539 cases of injury reported during the race. Muscle cramps were the predominant complaint (71.2%) of athletes and mainly occurred during the running stage. Owing to the high physical demand during the cycling stage, lower limb muscles, especially those of the calf, hamstring, and thigh are prone to cramping during the subsequent stage.¹⁶ Contrary to the previous belief that muscle cramps were associated with heat,¹⁷ dehydration, and electrolyte

imbalance,¹⁸ recent studies have concluded that a history of muscle cramping and an overall faster race time are the main predictors of muscle cramping among athletes.^{19,20} This fact explains the reason for the increased number of athletes with muscle cramps during the running stage in the present study. As competitors increase their pace to cross the finishing line within the specified time limit, the medical team should expect to treat more athletes with muscle cramps during this final stage of the race. Other less reported injuries, but ones that have a potentially life-threatening outcome, were overexertion (15 cases), dehydration (16 cases), and hyponatremia (2 cases). Although uncommon, the medical team should be prepared and equipped with the appropriate knowledge and skills to treat such conditions, to avoid any catastrophic events.

As mentioned above, the majority of injured athletes in the current study were seen during and immediately after the running portion of the race. The medical team treated few injuries in the first few hours after the start of the race, with most complaints coming during the swimming segment of the race. There was an influx of athletes seeking medical assistance beginning from 15:00 hours, seven hours after the race started. The number of injured athletes peaked between 18:00 and 18:59 hours, with 122 athletes receiving treatment during this period. This trend was expected because the majority of athletes were already in

the running stage or had begun to cross the finishing line. A similar trend has been observed in other ultra-distance triathlons.^{14,21} This information, together with the fact that non-elite athletes may take a longer time to complete the race, approximately 14 to 17 hours or more,²² indicates that amateur or first-time competitors require particular attention from the event organiser and medical team. Adequate allocation of medical personnel and facilities are essential to manage the influx of injured athletes during the above-mentioned critical points in the race.

Some limitations of the study need to be considered. Determining the correct definition of injury and illness in relation to triathlon sports was the major limitation in this study. Unlike other sports that have uniform consensus recommendations for injury and illness,²³⁻²⁵ these definitions vary among published studies of triathlon sport. Furthermore, this variation makes comparisons of the injury incidence rate difficult. This issue has been pointed out in several articles.^{11,26} To overcome this

and as recommended by Clarsen et al.,¹¹ the authors used a common definition for this study, as mentioned in the Methods section. Secondly, we were unable to determine any association between risk of injury and training habits, previous history of injury, and level of past event participation. This was owing to limited data available from the medical encounter form. The medical team involved plans to add additional variables, including those mentioned above, to a revised medical encounter form, to provide better data capture for future analysis.

Conclusion

In conclusion, the competing athletes in this study sustained a wide range of injuries that were mostly seen during or immediately after the running stage of the triathlon race. The medical team presents at the triathlon events should anticipate the types of injuries described here and should formulate an effective medical plan for such competitions.

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