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Retinal Detachment Risk Among Athletes: Incidence, Predisposing Factors and Preventive Strategies

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Abstract

Background: Retinal detachment is a severe emergency that can lead to permanent vision loss and other complications if not promptly treated. Among athletes, the risk of retinal detachment is caused by a combination of mechanical trauma, ocular health problems and factors specific to a sport.

Aim: The aim of this review is to examine the incidence of retinal detachment within athletes, describe high incidence sports, identify predisposing factors, and discuss how to be safely involved in various athletic activities. Evidence suggests that collision sports may increase the likelihood of retinal injury due to blunt ocular trauma and increase the risk of peripheral retinal lesions in elite athletes.

Material and methods: A structured literature search of PubMed and Google Scholar (2000-2025) was conducted using terms related to retinal detachment in athletes, sports-related eye injuries, protective eyewear, risk and predisposition factors, ocular trauma. English-language publications were analyzed.

Results: Evidence indicates that high-risk sports increase the likelihood of retinal injury and retinal detachment. The significance of using the proper eye protection is crucial. Ninety per cent of all sport-related ocular injuries are likely to be preventable with proper eye protection. What is more, the collaboration between sports medicine professionals and ophthalmologists is pivotal to educate and guide sports athletes.

Conclusions: Understanding the risk factors is a core for the development of preventive strategies, the need for regular ophthalmic visits in athletes' population, protective eyewear recommendations, and dedicated guidelines for athletes with enhanced risk. In spite of preserving long-term visual health in athletes there is a need for a balance between the benefits of sports participation and fathoming their hobby while broadening their knowledge and taking care of their health.

Key words: Retinal detachment; Athletes; Sports-related eye injuries; Collision sports; Ocular trauma; Risk factors for retinal injury; Sports participation safety; Protective eyewear; Vision preservation

Introduction:

Sports are among the most common causes of traumatic eye injuries worldwide [1]. One of the most hazardous consequences is retinal detachment (RD), an ophthalmic condition caused by the separation of the neurosensory retina from the underlying retinal pigment epithelium. Retinal tears are most common located in the infratemporal or supratemporal quadrants [1]. If not promptly treated, retinal tears might lead to RD, and this specific condition might cause an impaired retinal function and even potential permanent vision loss. Retinal detachment following ocular trauma represents one of the leading causes of blindness and visual impairment globally [2]. In the absence of a universally accepted definition of traumatic RD, studies propose a practical approach. Classification as traumatic should rely primarily on the individual clinical history and findings from the physical examination rather than on epidemiologic criteria. It is proposed to classify traumatic RD as rhegmatogenous retinal detachments caused by retinal tears, breaks or holes that were caused from ocular trauma. What is more, retinal breaks caused by trauma usually develop at the time of injury [3]. The symptoms of RD or retinal tear include blurred vision, flashes of light, floaters, spots or cobweb-like shapes, decreased visual activity, peripheral vision loss and a curtain, shadow or veil spreading across part of visual field [1]. It is essential that athletes understand the risks associated with participation in specific sports and recognize the risk category to which their chosen activities belong to preserve their health. It is also important that athletes with pre-existing retinal abnormalities are aware of the increased risk associated with participation in their sport and stick to the guidance provided by their physician. The importance of this is crucial due to significantly more prevalent occurrence of

peripheral retinal lesions in collision sport athletes [4]. Understanding the risk of retinal detachment, the hazardous sports and using preventive strategies such as protective eyewear can protect the athletes and decrease the number of RD and eye injuries [5]. The protection of the athletes is crucial and the responsibility lies with sports medicine to educate properly.

Epidemiology in high-risk sports

Retinal detachment represents a severe and serious problem according to high-risk athletes and may negatively affect their quality of live in multiple ways. Epidemiology suggests that this condition in some of the sports is more frequent than in the others, it varies on risk factors such as collision sports, rapid head movements and activities such as weightlifting. Evidence suggests that RD is a pathology with an incidence of 5 to 20 cases per 100,000 person-years [6]. Approximately 7,300 new cases occur annually in the United Kingdom [7]. In the United States alone, an estimated 600,000 sports-related eye injuries occur each year, generating healthcare expenditures exceeding $300 million [8]. The incidence of rhegmatogenous retinal detachment increases with age, is higher in men than in women, occurs more frequently in right eyes, and shows a strong association with higher socioeconomic status [7]. Among the athletes this problem represents a significant and serious health concern. Given that approximately 80% of perceptual input in sports is visual, optimal eye health is fundamental to sportsmen [9]. Athletes involved in collision sports are particularly exposed to frequent and forceful impacts, resulting from direct contact with other players, sports equipment, or the surrounding environment [4]. In one study based in Helsinki nearly 13% of eye injuries were sports-related in population of new eye injury [10]. Examples of high-risk collision sports include rugby, boxing, and judo, which inherently carry an increased risk of head and ocular trauma due to their combative and physically demanding nature. In contrast, non-collision sports such as swimming, cycling, rowing involve minimal to no physical contact between participants or with equipment, thereby reducing the likelihood of head or ocular injuries [4]. This distinction is crucial for understanding the biomechanical mechanisms underlying sports-related ocular trauma and for assessing the implications of different sports disciplines on retinal health. In the United States there were the significant increase in soccer-related eye injuries in 1973 to 1978 which measured 260%. It was probably caused by rise in popularity among children. Study suggests that it may become the most common cause of sport eye injury [11]. In another study, it was shown that ocular injuries by soccer ball disproportionately affect younger players and

are associated with more severe visual outcomes than previously recognized [12]. A study from England demonstrated that squash was the most frequent cause of sports-related ocular injury followed by soccer and badminton. In 2021, Korea, it was soccer, baseball, and badminton. On the other hand, in China, Australia and Sweden study indicates that the most common causes of sports-related ocular trauma were handball, soccer, and floorball. According to traumatic eye injuries, in a study based in Alabama, blunt injury, which can be caused by ball injuries, was the most common type of injury reported. The retina was harmed in nearly half of cases, the sclera in 8%, and the optic nerve in 5% [1]. In other studies, the evidence showed that the overall risk of ocular injury in sports such as baseball, basketball, cross-country, football, golf, soccer, swimming and diving, track and field, water polo, softball, and volleyball is low, the use of protective eyewear should still be considered in athletes with pre-existing ocular conditions. Decisions regarding eye protection should prioritize individual ocular history and retinal risk factors rather than the specific sport, as appropriate protective eyewear may significantly reduce the risk of preventable vision-threatening injuries [13].

Risk factors and predisposition to retinal detachment in athletes

The most common risk factors for retinal detachment concludes lattice degeneration and ocular trauma [14]. Predisposition to RD is described in patients with myopia, lattice degeneration, high-risk breaks, family history of RD and contralateral retinal detachment [15-16]. Also, ocular surgeries are important risk for RD, particularly cataract surgery. Vitrectomy is another predisposition for RD or recurrent RD [16]. Heavy occupational lifting and being overweight may be important risk factors for RD among myopic patients, and their role in development of RD should be examined in more general populations [6,17-18]. Differences in retinal flexibility may explain why the macula and the vitreous base are more prone to tearing. Vitreous traction may not be the main cause of retinal damage after blunt trauma and may actually help absorb shock. Instead, rapid and complex forces acting in different directions can create negative pressure that leads to retinal tears and detachment [19]. In high-risk sport athletes there are evidence that risk of RD is significantly higher. Boxing and rugby players have notably higher prevalence of peripheral retinal lesions compared to athletes in non-collision sports. That indicates a potential link between the nature of high-risk sports and retinal detachment comparable to low-risk sports [4]. Neither age, sex, nor eye involvement showed a significant association according to retinal detachment, but the highest incidence was in adults between 50 and 70 years old [14] [16]. Findings indicate that retinal detachment is associated with longer

periods of disability compared with retinal tears or less severe ocular injuries and is more likely to limit return to sport. These data support ophthalmologists in counseling athletes regarding expected recovery timelines and the probability of resuming athletic participation [20].

Classification of sports – high, moderate and low risk according to eye injuries

The classification of sports is crucial for the better understanding relatable more hazardous sports due to eye injuries. The classification according to eye injuries results from the characteristics of each sport, including the type of equipment used, the speed and size of projects, incidents of physical contact, and the likelihood of direct ocular impact. This classification is essential for identifying athletes at increased risk and for guiding recommendations regarding preventive strategies, such as the use of appropriate protective eyewear and individualized counseling based on ocular history. Education of athletes, coaches, children and their parents may lead to broadening knowledge of athletes and should be considered. Raising awareness of retinal risks and promoting the use of protective eyewear in high-risk sports is essential to maintaining eye health. The collaboration between ophthalmologists and athletes is pivotal [9].

1. High-risk sports for retinal detachment

High-risk athletes are in frequent exposure to small, high-speed projects which are in a constant or intermittent contact with them, it also involves sports with bat or stick [9]. Rapid head movements, such as those experienced on roller coasters and weightlifting also provides high-risk according to RD [17,21]. Sports that are prone to ocular trauma due to contact with other athletes which can lead to blunt trauma are also in this group. Blunt trauma from sports balls can lead to equatorial expansion of the eyeball, generating vitreoretinal traction that may culminate in retinal tears or retinal detachment. Examples of these sports includes badminton, baseball, basketball, cricket, boxing, judo, ice-hockey, field hockey [9]. For athletes participating in these disciplines, the use of appropriate protective eyewear and regular ophthalmic screening are strongly recommended to reduce the risk of severe retinal injury.

2. Moderate risk sports for retinal detachment

On the other hand, the definition of moderate risk sports contains sports with high-speed ball, aggressive body contact and use of bat or stick. According to available studies it involves American football, football, archery or darts [9]. Although severe eye injuries are less common in these disciplines, the potential for blunt ocular trauma or accidental eye impact remains present. Such injuries may result from collisions between players, contact with sports equipment, which can lead to retinal tears or retinal detachment, particularly in athletes with pre-existing retinal vulnerabilities. Therefore, athletes participating in moderate-risk sports should be educated about ocular injury prevention and encouraged to consider protective eyewear, especially if individual risk factors for retinal detachment are present.

3. Low risk sports for retinal detachment

Low risk sports are associated with low incidence of RD and other traumatic eye injuries and described as not involving a thrown or hit ball, stick, bat or aggressive play. Examples are cycling, rowing, swimming, canoeing or athletics [9]. These sports may be recommended by sports medicine physicians for athletes who are predisposed to retinal tears or who have undergone a major eye surgery. Participation in low risk sports may contribute to the maintenance of retinal health by minimizing mechanical stress and reducing the risk of ocular injury. For example, patients with peripheral lattice degeneration, as well as those treated surgically for retinal detachment should refrain from abrupt head movements because vitreous body vibrations may trigger retinal detachment. Therefore, contact sports are not recommended. The safety of running is still debated, while cycling and swimming are considered safe and beneficial [22].

Protective eyewear

The use of eye protection has reduced the incidences of eye injuries worldwide [23]. 90% of ocular trauma can be preventable while wearing proper protective eyewear. This specific protection is made of polycarbonate, which is a highly impact-resistant plastic. As these are now easily available in both prescription and non-prescription forms, all players should be actively encouraged to use them [24]. Protective eyewear made of polycarbonate reduced the

strain on the retina by 69% and 47%, significantly decreasing the severity of eye deformation upon impact [25]. It indicates that education of athletes about potential risk is crucial to maintain the retinal health. Education due to protection of eyes in sports confirmed benefits and have potential of prevention injuries to over a thousand eyes a year [24]. More emphasis should be given on prevention of eye injuries by using protective eyewear even though vision after surgical intervention after eye injuries can be easily achieved [26]. Education should not only involve athletes, but also children, their parents and coaches. Educational interventions targeting athletes, coaches, parents, and sports organizations were shown to improve awareness and adoption of preventive strategies. The number of eye injury incidents reduced by almost 70% by education that targeted athletes by study based in India [27]. It is crucial that rules of wearing eye protection should be extended, as well new recommendations and policies on protective eyewear use [28]. In contrast, contact lenses provide no protective benefit and are not considered appropriate protective equipment [24]. Eye googles are specially made for some of the sports, the examples involve:

1. Basketball, football, tennis

Eyewear protection with polycarbonate lenses [24]. Properly fitted goggles can significantly reduce the risk of retinal tears or detachment caused by ball impact.

2. Baseball, softball

Batter's helmet equipped with a polycarbonate or wire face guard, and sports goggles with polycarbonate lenses for field players [24]. Helmets and goggles protect against balls and collisions, reducing the likelihood of blunt ocular trauma.

3. Hockey

Full face mask for the goalie, and sports goggles with polycarbonate lenses for field players [24]. Full-face protection is especially important for preventing facial and retinal injuries.

4. Football

Polycarbonate eye shield attached to a wire face mask [24]. Eye shields minimize the risk of direct trauma to the eye by contact with the ball or accidental contact with another player.

5. Ice hockey

Helmet with full-face protection [24]. Full-face helmets prevent both direct impact from pucks and sticks and secondary trauma from falls on the ice.

6. Lacrosse

Full-face protection, or alternatively sports goggles with polycarbonate lenses or a wire mesh [24]. These prevent high-speed ball injuries and collisions with other players.

7. Paintball

Full-face protection [24]. Paintball masks protect against high-velocity projectiles that can cause serious retinal damage.

8. Skiing

High-impact-resistant eye protection or sports goggles with polycarbonate lenses**.** All protective eyewear should also provide ultraviolet and excessive sunlight filtration **[24].**

9. Racket sports

Sports goggles with polycarbonate lenses [24]. Goggles protect from fast-moving balls and accidental racket contact, lowering the risk of retinal tears or detachment.

Results

The analysis of available literature demonstrates that sports-related ocular trauma remains a significant cause of retinal detachment, particularly among athletes participating in high-risk disciplines [1]. Evidence consistently indicates that collision sports and activities involving high-speed projects and blunt ocular impact are associated with an increased prevalence of retinal tears and peripheral retinal lesions [4]. Athletes exposed to repetitive blunt trauma or rapid head movements, such as those occurring during weightlifting or high-acceleration activities, showed a higher susceptibility to vitreoretinal traction, which may lead to retinal tears and detachment, particularly in predisposed individuals [6,17-18]. Predisposing factors

frequently reported across studies included myopia, lattice degeneration, prior ocular surgery (especially cataract surgery and vitrectomy), family history of RD, and previous retinal detachment in the fellow eye [15-16]. Epidemiological data revealed notable geographic variability in the incidence of sports-related eye injuries, with soccer, squash, baseball, badminton, handball, and floorball emerging as leading causes depending on the region. Importantly, multiple studies confirmed that the majority of sports-related ocular injuries are preventable [24]. The use of appropriate protective eyewear, particularly polycarbonate sports goggles and full-face protection, was shown to significantly reduce the risk of eye injuries [23]. Educational interventions targeting athletes, coaches, parents, and sports organizations were shown to improve awareness and adoption of preventive strategies. The number of eye injury incidents reduced by almost 70% [27]. Prevention of RD may be achieved by early diagnosis of retinal teras and regular visits to ophthalmologists [4]. Most rhegmatogenous retinal detachment are idiopathic, however traumatic RD can often be prevented through the use of protective eyewear [16].

Conclusion

Retinal detachment represents a serious and potentially vision-threatening complication of sports-related ocular trauma, particularly among athletes engaged in high-risk and collision sports. The findings of this review highlight that the risk of RD is multifactorial, influenced by the type of sport, biomechanical forces involved, and individual predisposing factors such as myopia, peripheral retinal degeneration, and prior ocular surgery. Proper classification of sports into high-, moderate-, and low-risk categories is essential for guiding clinical recommendations and enabling athletes to make informed decisions regarding sports participation. The widespread availability and proven effectiveness of polycarbonate protective eyewear underscore its critical role in preventing sports-related eye injuries. Mandatory or strongly recommended use of appropriate eye protection in high-risk sports, combined with targeted educational programs, has the potential to substantially reduce the incidence of retinal detachment and long-term visual impairment. In conclusion, improving awareness of retinal risks, promoting preventive strategies, and fostering collaboration between ophthalmologists, sports medicine specialists, and athletic communities are fundamental to safeguarding ocular health in athletes. Early education, risk stratification, and adherence to protective measures remain the most effective approaches to minimizing the burden of retinal detachment associated with sports participation.

AI:

AI was utilized for two specific purposes in this research. Text analysis of clinical reasoning narratives to identify linguistic patterns associated with specific logical fallacies. Assistance in refining the academic English language of the manuscript, ensuring clarity, consistency, and adherence to scientific writing standards. AI were used for additional linguistic refinement of the research manuscript, ensuring proper English grammar, style, and clarity in the presentation of results. It is important to emphasize that all AI tools were used strictly as 7assistive instruments under human supervision. The final interpretation of results, classification of errors, and conclusions were determined by human experts in clinical medicine and formal logic. The AI tools served primarily to enhance efficiency in data processing, pattern recognition, and linguistic refinement, rather than replacing human judgment in the analytical process.

Disclosure

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