Sunshine on Holidays – Eye Risks

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ABSTRACT

Ultraviolet (UV) light is the most common cause of radiation injury to the eye which in acute exposure causes photokeratitis and phot Conjunctivitis. After a whole day exposure to the sun on the Mediterranean coast patient presented with mixed conjunctival injection, chemosis, edematous corneal epithelium with superficially present fluorescein positive small pinpoint defects. Epithelial bullous changes, circular stromal infiltration in the middle stromal periphery and reduction of corneal transparency were more pronounced on the left eye. After treatment moderate conjunctival injection remained together with circular stromal infiltration in the middle periphery, corneas were transparent, epithelialised and fluorescein negative. Anterior chambers and lenses were clear. One month after patient regained bilateral visual acuity of 1.0. To our knowledge, this case shows for the first time connection between acute ultraviolet radiation exposure and persistent circular stromal infiltration in the middle corneal periphery in humans.

Key words: ultraviolet rays, epithelium, cornea, keratitis, keratoconjunctivitis

Introduction

Human behaviour regarding to sun exposure is of the main importance in respect of the health risks. Increasing popularity of outside activity like sports, spending holidays on sun and outdoor lifestyle connected with the wearing of minimal clothing without proper protective measures (sunglasses and sunscreens) stands threat for human health¹. Sun is the main source of ultraviolet radiation (UVR) that contributes to the personal exposure. Solar UVR is conventionally divided into UVA (315–400 nm), UVB (280–315 nm) and UVC (100–280). Potentially the most dangerous of the three are UVB and UVC. UVC is absorbed by the earth atmosphere and UV-B radiation is effectively attenuated by the stratospheric ozone layer, but it is not fully blocked². It penetrates only superﬁcially being absorbed in tissues affecting directly the eye and the skin. UV light is the most common cause of radiation injury to the eye which in acute exposure causes photokeratitis and photoconjunctivitis (inflammation of the cornea and conjunctiva, respectively). This condition is presented with inflammatory response with conjunctival chemosis and injection, photophobia, blepharospasm and increased lacrimation. Photokeratitis is presented by small, fine pinpoint lesions of the epithelium which stain with fluorescein, known as superficial punctate keratitis. In severe cases it can be characterised by epithelial desquamation³. Reepithelisation usually occurs within few days (prolonged and repeated exposure to UVR can be associated with several ocular disorders eg. pinguecula, pterygium, climatic droplet keratopathy, cataract and even squamous metaplasia and carcinoma.)⁴–⁹. Normally the retina is protected from acute damage caused by UVR, but Sun-gazer retinopathy is described in some psychiatric patients who stare directly in the sun¹⁰.

Case Report

On August 10, 2006., 51 year old man, previously treated for 10 days in other Hospital, was admitted to our Department complaining on bilaterally decreased visual acuity, irritation, pain, photophobia, blepharospasm and increased lacrimation. Photokeratitis is presented by small, fine pinpoint lesions of the epithelium which stain with fluorescein, known as superficial punctate keratitis. In severe cases it can be characterised by epithelial desquamation³. Reepithelisation usually occurs within few days (prolonged and repeated exposure to UVR can be associated with several ocular disorders eg. pinguecula, pterygium, climatic droplet keratopathy, cataract and even squamous metaplasia and carcinoma.)⁴–⁹. Normally the retina is protected from acute damage caused by UVR, but Sun-gazer retinopathy is described in some psychiatric patients who stare directly in the sun¹⁰.

Received for publication October 1, 2006.
particularly in paralimbal location, chemosis, edematous corneal epithelium with superficially present fluoresceine positive small pinpoint defects. Epithelial bullous changes, circular stromal infiltration in the middle stromal periphery and reduction of corneal transparency were more pronounced on the left eye (Fig 1A). Anterior chambers of both eyes were clear with artificially dilated pupils and transparent lenses. Details of vitreal body and fundus appearance were not available for inspection due to the lost of corneal transparency. Ultrasound exam and intraocular pressure were normal. Best corrected visual acuity (BCVA) of the right and left eye was 0.3 and 0.1 respectively. To exclude infection of the corneal abrasion of the corneal epithelium of the left eye was done and specimen was sent for microbiological and Acanthamoeba hystolitica analysis (both specimens were negative). Both eyes were treated topically with tobramicin solution and ointment, atropinum (1% solution) and artificial lubricants.

After specimens for microbiology were taken patient received systemic therapy with amoxicilinum. Visual acuity continuously recovered from the second day of the hospital admittance, and at 17 days after solar injury patient regained bilateral visual acuity of 0.7 (1.0 pinhole) in both eyes. Moderate conjunctival injection remained, together with circular stromal infiltration in the middle periphery, corneas were transparent, epithelialised and fluorescein negative. Anterior chambers and lenses were clear (Fig 2A and 2B). One month after solar injury patient regained bilateral visual acuity of 1.0.

Discussion

In usual conditions human beings are constantly exposed to either solar or artificial ultraviolet radiation. According to some data approximately 8% of solar radiation above the atmosphere is UVR which can be approx. 45% higher at the sea level depending on position of the sun in the sky (geographic location and season) and atmospheric conditions like cloud cover and ozon concentration. The ozon plays important protection role in reducing UVB radiation, and cloudinesses could decrease UVB levels by 90% or more.

The eye represents less than 2% in the constitution of whole body surface. Although its anatomic position and structure protects the eye; it is sheltered with eyebrows, eyelashes, by pupil constriction and eyelids closure it is not enough defence against UVR effect. Due to its specific function in light transmission, the transparent media absorb varying amount of UV radiation. Among them the cornea absorbs most UV radiation. UV rays irritate the superficial corneal epithelium, causing inhibition of mitosis, production of nuclear fragmentation, and loosening of the epithelial layer. This effect depends on the specific chemical composition of the cell due to absorbing...
molecules or chromophores\(^{17}\). It is well known that more absorbed radiation carry the greater effect on cells and tissues. For example, the nucleic acids and most proteins in cell are transparent and transmit visible light, but absorb some spectar of UV radiation (between 250 and 295 nm) that can damage the cell. It has been shown in some studies that experimental photokeratitis occurred at approximately 300 nm with a smaller peak at 295 and 320 nm\(^{18}\). It is important to stress out that ocular lens sustains greatest effect and photochemical change during a lifetime because of exposure to UVR\(^{19}\). The most important effect of UVR on cell is DNA alteration – formation of single-strand breaks (SSBs) and double strand breaks (DSBs)\(^{20,21}\). Some base sustances like pyrimidine dimer\(^{22}\) with consequential repair mechanisms\(^{23,24}\) which in case of failure may result in death or mutation of the cell.

In our patient solary induced keratitis lasted almost one month: reappearance of corneal surface and regaining of visual acuity was extremely prolonged. According to the literature cornea is usually fully reepithelised in a few days (36–72 hours)\(^{26}\) except in cases of long-term sequelae resulting from superinfection. However, all preformed microbiological tests in our case were negative! Possible explanation for such a long recovery period in a presented case might be that the absorbed UVR damaged a whole population of corneal epithelial layer including progenitory limbal stem cells essential for constant epithelial regrowth an regeneration. Experiments in animals have shown phototoxic effect at all levels of the cornea (including stroma and endothelium)\(^{19,27}\).

To our kownledge, this case shows for the first time connection between acute UVR exposure and persistent circular stromal infiltration in the middle corneal perifery in humans. At the last ophthalmologic exam two months after injury there was no signs of cortical cataract or other non malignant disoders like pterygium, pinguecula or climatic droplet keratopathy which are conditions associated with chronic exposure to UVR\(^{25}\). Some studies also report induction of anterior lens opacities in the eyes of rabbits after UVR exposure\(^{28}\).

Although short exposure to UVR has beneficial effect for human health (vit D generation) which is specially important for people who do not ingest vitamin D in food, it is obvious that it has harmful effect on both the eye and rest of the body (skin, immune system). For that reason also, education and protective methods to lower incidence of UVR damage (like covering, filtering and shading)\(^{29}\) is of the special importance.

\[\text{REFERENCES}\]


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IZLOŽENOST SUNCU I RIZICI ZA OKO

SAŽETAK

Ultravioletno (UV) zračenje je najčešći uzrok radijacijske ozljede oka koja pri akutnoj ekspoziciji uzrokuje fotokeratitis i fotokonjunktivitis. Nakon cijelodnevne izloženosti Sunčevoj svjetlosti na Mediteranskoj obali pacijent je imao miješanu konjunktivalnu injekciju i kemozu, edem rožničnog epitela sa fluorescein pozitivnim površnim sitnočokastim defektima. Buloze epitelne promjene, kružna stromalna infiltracija u srednjoj rožničnoj periferiji i smanjena prozirnost rožnice bili su izraženiji na lijevom oku. Nakon provedenog liječenja još uvijek je bila prisutna blaga spojnačna injekcija sa kružnom stromalnom infiltracijom na srednjoj periferiji, rožnice su bile prozirne, epitelizirane i fluorescein negativne, a prednje sobice i leće bile bijele. Jedan mjesec nakon liječenja pacijent je obostrano postigao vidnu oštrinu 1.0. Prema našim saznanjima, ovaj slučaj prvi put u ljudi pokazuje povezanost između akutne izloženosti UV zračenju i pojave persistentne stromalne infiltracije u rožničnoj srednjoj periferiji.