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Professional paper

Sunshine on Holidays – Eye Risks

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A B S T R A C T

Ultraviolet (UV) light is the most common cause of radiation injury to the eye wich in acute exposure causes photokeratitis and photoconjunctivitis. After a hole day exposure to the sun on the Mediteranian coast patient presented with mixed conjunctival injection, chemosis, edematous corneal epithelium with superficially present fluoresceine positive small pinpoint defects. Epithelial bullous changes, circular stromal infiltration in the middle stromal perifery 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 perifery, 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 kownoledge, this case shows for the first time connection between acute ultraviolet radiation exposure and persistent circular stromal infiltration in the middle corneal perifery 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 health[1]. 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). Pottentially the most dangerous of the three are UVB and UVC. UVC is absorbed by the earth amosphere and UV-B radiation is effectively attenuated by the stratospheric ozone layer, but it is not fully blocked[2]. It penetrates only superfitially being absorbed in tissues affecting directly the eye and the skin. UV light is the most common cause of radiation injury to the eye wich in acute exposure causes photokeratitis and photoconjunctivitis (inflamation of the cornea and conjunctiva, respectively). This condition is presented with inflammatory response with conjunctival chemosis and injection, photofobia, blepharospasm and increased lacrimation. Photokeratitis is presented by small, fine pinpoint lesions of the epithelium wich stain with fluorescein, known as superficial punctate keratitis. In severe cases it can be characterised by epithelial desquamation[3]. Reepithelisation usually occurs within few days (prolonged and repeated exposure to UVR can 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 sun[10].

Case Report

On August 10, 2006., 51 year old man, previously trated for 10 days in other Hospital, was admited to our Department complaining on bilateraly decreased visual acuity, irritation, pain, photophobia, blepharospasm, foerign body sensation and tearing of both eyes. These simptoms occured accutely in the nigh-time, after a hole day exposure to the sun on the Mediteranian coast. Slit lamp examination showed mixed conjunctival injection

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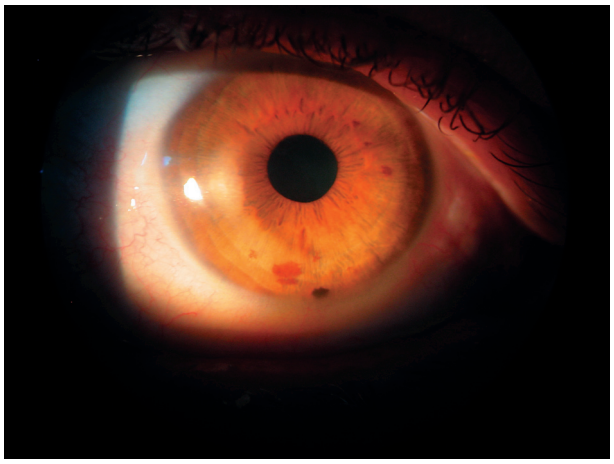
particularly in paralimbal location, chemosis, edematous corneal epithelium with superficially present fluoresceine positive small pinpoint defects. Epithelial bullous changes, circular stromal infiltration in the middle stromal perifery and reduction of corneal transparency were more pronounced on the left eye (Fig 1A). Anterior chambers of both eyes were clear with artificially dilatated 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 corected visual auity (BCVA) of the right and left eye was 0,3 and 0,1 respectivelly. To exclude infection of the cornea 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 artifitial lubrificants.

Figure 1. Patient's left eye 10 days after prolonged exposure to UVR. Corneal epithelium is edematous with bullous changes and circular stromal infiltration is present in middle perifery.



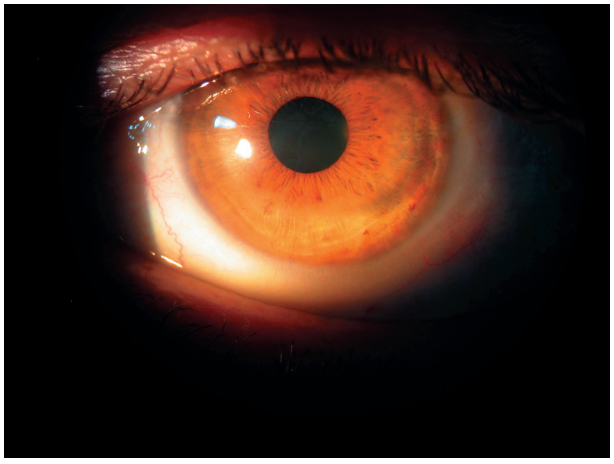


Figure 2. and 3. Patient right (2) and left eye (3) eye one month after solar injury. Eyes ere quiet, only moderate conjunctival injection remained together with circular stromal infiltration in the middle perifery. Corneas are transparent, epithelialised and fluorescein negative. Anterior chambers and lenses are clear.

After specimens for microbiology were taken pacient received systemic therapy with amoxicilinum. Visual acuity continuosly recovered from the second day of the hospital admitance, 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 perifery, 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 artifitial 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 pozition of the sun in the sky (geographic location and season)[11,12] and atmospheric conditions like cloud cover and ozon concentration[13]. The ozon plays important protection role in reducing UVB radiation, and cloudinesses could decrease UVB levels by 90% or more[14,2].

The eye represents less than 2% in the constitution of whole body surface. Although its anatomic position and strucure 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[15]. UV rays irritate the superficial corneal epithelium, causing inhibition of mitosis, production of nuclear fragmentation, and loosening of the epithelial layer[16]. 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 occured 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 photohemical 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), DNA to protein crosslinks (DPCs) and double strand breaks (DSBs)[20,21]. Some base supstancies like pyrimidine are also affected formating pyrimidine dimer[22,23] with consequential repair mechanisms[24,25] which in case of failure may result in death or mutation of the cell.

In our patient solary induced keratitis lasted almost one month: reepithelisation 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 migh 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. Experimets in animals have shown phototoxic effect at all levels of the cornea (including stroma and endothelium)[19,27]. To our kownoledge, 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[5–9]. Some studies also report induction of anterior lens opacities in the eyes of rabbits after UVR exposure[28].

Although short exposure to UVR has benefitial 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 incident of UVR damage (like covering, filtering and shading)[29] is of the special importance.

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IZLOŽENOST SUNCU I RIZICI ZA OKO

S A Ž E T A K

Ultravioletno (UV) zračenje je najčešći uzrok radijacijske ozlijede 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 sitnotočkastim defektima. Bulozne 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 spojnična injekcija sa kružnom stromalnom infiltracijom na srednjoj periferiji, rožnice su bile prozirne, epitelizirane i fluorescein negativne, a prednje sobice i leće bistre. Jedan mjesec nakon liječenja pacijent je obostrano postigao vidnu oštrinu 1.0. Prema našim saznanjima, ovaj slučaj prvi puta u ljudi pokazuje povezanost između akutne izloženosti UV zračenju i pojave perzistentne stromalne infiltracije u rožničnoj srednjoj periferiji.