

SOME SKIN DISEASES CAUSED BY SOLAR RADIATIONS AND THE IMPORTANCE OF THEIR PREVENTION

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Abstract

Solar radiations, especially the UV radiations are causing on the normal skin a series of solar dermatitis, the premature aging of the skin, pre-cancerous lesions, and skin cancers after prolonged exposure; being either chronic or intermittent in nature. The most exposed to this risk are children and individuals which have the skin phototype I and II; the lack of prevention and protection methods can be added on top.

The study was conducted on a number of 116 subjects with ages between 10 and 60 years old, of both genders, from urban and rural environments. The subjects had an anamnestic and clinical exam based on the dermatological investigations and dermoscopy, looking to identify pre-cancerous lesions and skin cancer, sun burns while determining the skin phototype and taking notice of any solar prevention and protection practices.

Study results show a high number of subjects with skin phototypes of type I and II, which have a history of solar burns; a high number of actinic keratosis and skin cancers especially for patients located in the rural area with a high exposure track record and without solar protection; but at the same time, an increase in the use of solar protection methods by the young population.

In conclusion, in order to decrease the incidence of solar dermatitis and skin cancers, the most important method of prevention is given by the use of solar protection products and by limiting the exposure to solar radiations.

Key words: (maximum 6): UV radiations, skin phototypes, dermatitis, prophylaxis, sun protection

INTRODUCTION

It is known that the sun is emitting a large spectrum of electromagnetic radiations and Earth's atmosphere, through absorption, is partially filtering these radiations. The transmission through the atmosphere of radiation is influenced by the ozone layer found in the stratosphere but in the last decades, because of the thinning of the ozone layer the radiation dose which reaches ground level is higher.

Electromagnetic radiations with a large specter are starting from ultraviolet radiations and end with infrared radiations. The ultraviolet radiations B (UVB) have a wavelength between 290-320nm; these are the main type of erythematous generating while ultraviolet radiations A (UVA), named also "black light" have a wavelength of 320-400nm.

Visible light, is the light which is detectable by the human eye and has a wavelength of 400-760nm. The most important radiations which have an effect on our skin are UVA, UVB, UVC but visible radiation can also cause a series of skin effects. Even though the skin has a natural protection

mechanism against solar radiation, stemming from the epidermis and the melanin content which differs from one person to another; skin reactivity is largely conditioned by genetic factors. Protection is directly proportional with the melanin content and the photo-biological response of the skin is given by the penetration and absorption of radiations with wavelength in the range where the organism is sensible. Once on the skin, solar radiation penetrates it creating on its surface a series of effects; some normal and some causing afflictions which are commonly called solar dermatitis. UVB radiation is responsible for the apparition of actinic erythema, sun burns, but it also acts upon the DNA, RNA and proteins by inhibiting mitosis and inducing carcinogenesis. UVA radiation is responsible for immediate pigmentation. Melanin load of the skin can be determined on the skin areas which are not exposed to sun and race type is playing a role as well. Skin responds to short sun exposures, under 30 minutes, through erythema with different intensity grades from one person to another; or through a long-lasting pigmentation (tanning) but the intensity of it varies from one person to another. The proportion in which these two reactions to UV radiations are seen can be differentiated in 6 main skin phototypes based on Fitzpatrick, numbered from I to VI, depending on skin reactions after a 30 minute sun exposure during the warm season. The fundamental skin color can be white, brown or black, but not all “white” skinned people have the same tanning capacity; this aspect being the main criteria for differentiating “white” people. Therefore people with skin phototype I have a white skin, pale, blonde or red hair, and are easily getting severe and painful sunburns while they are unable to tan. People with skin phototype II have a white skin, are subjected to sunburns and tan with difficulty with a light shade. Skin phototype III includes white skin people but these are subjected to light sunburns and are getting a darker shade when tanned. Skin phototype IV includes people with light brown skin or olive-like, they do not suffer sunburns and tan easily with an intense nuance. Skin phototype V includes people with brown skin while people with black skin are part of skin phototype VI. Skin phototypes V and VI are considered racial skin phototypes.

The most encountered skin occurrences are “acute” in character and are noticed on normal skin after a short exposure. These are actinic erythema and sunburns often seen at white skinned people, especially skin phototypes I and II, less in type III. Actinic erythema is manifesting clinically through an intense erythema, edema and in sunburns there are vesicles and bubbles. Lesions are sudden, after an exposure of 4-6 hours, strictly in the exposed areas and are painful. In severe burns, general condition is altered with headaches, fever, vomiting, chills and tachycardia. They can heal spontaneously but solar freckles and depigmentation can

appear. Sunburns from childhood are a risk factor for the apparition of malign melanoma. Reaction intensity is higher in people with skin phototype I and II. In sunburns, treatment revolves around using wet compress, sprays or creams with topical corticosteroids and in severe cases the use of non-steroid based anti-inflammatories is recommended or prednisone. However, normal skin through prolonged chronic sun exposure suffers in time a series of skin manifestations called dermatoheliosis, these represent aspects of photo-induced premature aging. Photo-induced premature aging is a complex process which influences the entire human body, especially the skin where the effects are most visible. Clinically, the skin is dry, rough, yellowish, elasticity drops, wrinkles and pigmentation appear, spider-like lines and solar keratosis as well as pre-cancerous lesions.

Chronic sun exposure is the main risk factor for the apparition of pre-cancerous lesions and skin cancers. These have an increased incidence in people with skin phototypes I and II. Treatment for all these types of acute and chronic afflictions is first of all prophylactic, preventive and based on photo protection. Photo protection is external and internal. External photo protection, is mechanical and has an important role. It is based on using cotton clothing, hats with large brims, sun umbrellas, while sun exposure is done progressively, in the morning until 11 o'clock and in the afternoon, after 16 o'clock. Chemical external photo protection consists of applications with sun screen lotions which protect by reflecting solar radiation and by selective absorption of UV radiation, while by absorbing UV radiation with median wavelength which is causing insolation and erythema, and while permitting access to long wavelength radiation which cause tanning. There are powder like concoctions which reflect UV radiation regardless of the wavelength, are not toxic, non-allergenic, protect the skin from UVA and UVB radiation. They contain an active substance with protective role and are totally stopping the radiation, called screens. Those which stop only a certain type of radiations are called filters. All concoctions can be found as creams, emulsions, lotions, gels and sprays. They have a certain protection coefficient with 5 photo protective classes depending on the quantity of protection material. Products with a high protection factor, 50 and above ensure photo protection from both UVB and UVA radiation, type A infrared radiation. There are photo protective products which ensure protection from skin cancers, protect cellular DNA and the skin from free radicals, pollution and premature skin aging. There are also products for babies and children.

MATERIAL AND METHOD

Chronic or intermittent exposure to solar radiation is increasing the risk of photo dermatitis, pre-cancerous skin lesions, and skin cancer but also of premature skin aging. All these can be prevented while other can be

delayed, attenuated through prophylaxis as today there are numerous prevention and protection methods available.

The study was conducted with the scope of pointing out the apparition of photo dermatitis and skin cancers caused by excessive, intermittent, prolonged and chronic to solar radiation of normal and healthy skin, the skin phototypes most frequently affected but also the possibilities of prevention and attenuation through prophylactic photo protection methods. The study done on a lot of 116 subjects with normal skin, ages between 10 and 60 years old, over a period of 21 months between 1 January 2017 and 30 September 2018, in a private dermatological practice from Oradea. The batch consisted of 77 subjects from the urban environment and 39 from the rural environment. Among these, 68 were females while 48 were males. All subjects were selected from patients which presented themselves at the dermatological practice for a dermatological consult meant to detect pre-cancerous lesions and skin cancer, for prophylaxis council and the prevention of all the above; as well as treatment for acute reactions from actinic erythema and sunburns. These patients did not show other skin diseases which would determine the aggravation or complication of already existing skin diseases. In order to conduct the study, the following parameters were evaluated: age, gender, environment (urban or rural), education level (school, high school, and university), and personal history of sunburns but also the use of prophylactic methods. Clinical dermatological examination focused on the following aspects: presence of acute manifestations caused by intense sun exposure over a short period of time; the existence of cancerous lesions and skin cancers, signs of premature skin aging but also the presence of previous sunburns, while at the same time, determining the skin phototype. Treatment options were also given in acute photo dermatitis, in pre-cancerous lesions and skin cancers, prophylaxis and solar protection, prevention of photo induced skin aging.

RESULTS AND DISSCUSIONS

The study was conducted on a number of 116 subjects, of both genders, coming from the rural and urban environment with ages between 10 and 60 years old. Study results regarding the provenience environment of subjects shows a higher percentage of patients from the urban environment, 66.37%, while the percentage of patients from the rural environment was 33.62%. Results are indicating a higher medic addressability for the females, 62.53% comparatively with males 37.07%.

Following the dermatological exam the categorization of skin phototype was defined such that out of the 116 subjects, 18 had phototype I meaning 15.5%, phototype II had 30 patients meaning 25.86%. Of phototype III there were 35 patients, meaning 31.71% and 33 patients had

phototype IV, meaning 25.86%. There were no patients of phototype V and VI, as these are not common in our geographical position. As far as education level goes for the patients, in the study, 10 patients were still in High school 8.62%; 28 subjects had secondary education 24.13%; 14 patients were in gymnasium (8 classes) 12.06% and 64 patients had upper-level education or are still in University, 55.17%. These results point out the increased interest for skin health of patients with higher level education when compared with other patients with lower education. From anamnestic data and patient history, 39 of these are denying the presence of acute reactions caused by sun exposure, 33.62%, while 29 patients acknowledge historical presence of actinic erythema, 24.13%; the other 48 patients admit the existence of sun burns in the past, 41.20%, all of which are coming from patients with skin phototype I and II, less from type III. From the study we can see the 53 patients, 45.68% have used mechanical photo protection means, and 67 of patients have used chemical photo protection means, 57.75%, and out of these, only 44 patients have used photo protection substances before and during sun exposure. 23 patients have used these substances after they have suffered from erythema and sun burns; and 24 patients, especially older ones and from rural area, have not used any kind of protection. Following the clinical and dermatoscopic exams, study results show that 46 of the patients, 39.65% display lasting marks from solar lentigines and skin depigmentation, all characteristic of phototypes I and II.

These examinations also pointed out that 4 subjects with ages between 50-60 years old with bas-cell squamous, 3.44% from the rural environment, 1 male patient of 59 years old with malign melanoma from the urban environment; and with actinic keratosis 21 persons between 48 and 60 years old representing 17.24%, all belonging to skin phototypes I and II. Therefore 26 of the subjects out of the total of 116 were diagnosed with pre-cancerous lesions and skin carcinoma, respectively 22.42%. Clinical manifestation of premature skin aging were identified in a number of 39 patients, respectively 6 men and 8 women from the age group of 40-49 years old and 8 men and 1 women from the group age above 60, meaning 33%. The presence of wrinkles, telangiectasia, pigmented spots, solar keratosis, and yellow skin, dry and rough with a diminished elasticity is contouring the panel of aged skin, much older than the age would dictate. All of these are due to excessive, prolonged and repeated sun exposure without proper protection.

DISCUSSIONS

Modern research has brought important information on the risk of solar dermatitis and skin cancers caused by the effect of solar radiation on

skin, mainly due to prolonged exposure, be it chronic or intermittent. The increased dose of radiation which reaches ground level is also caused by the thinning of the ozone layer and its function of filter, contributing to the increase of dermatitis and skin cancers.

Skin reaction to solar radiation also depends on the skin phototype, the skin sensibility to the sun, the intensity and duration of exposure. Recent research have underlined the importance of prophylactic and sun protection measures as a benefic therapeutic method for alleviating acute manifestations caused by intense exposure of short duration to the sun; and in case of prolonged and repeated exposure, by reducing the risk of skin cancer apparition and the process of premature photo induced skin aging.

The results of our study show a higher number of patients which have white skin compared to patients of other fundamental colors, results confirmed by other studies which points out the high percentage of persons with white skin, which is characteristic to geographic locations with temperate climate. Study results also underline an increased interest of white skinned persons, especially phototypes I and II, for preventing and early detection of skin cancers. Another relevant aspect of the study is the addressability to the specialist doctor of the patients from the studied group; the percentage is higher for consult and counseling for patients coming from the urban environment 66.37%, compared to ones coming from rural environment 33.63%. Sanitary education about the apparition of solar dermatitis and skin cancers through prevention and photo protection methods of the skin, is a strong necessity in our day and age due to increased incidence of skin cancers, as reflected in numerous studies and literature researches.

The importance of educating the population for prophylaxis and prevention of solar radiation effects, especially the apparition of skin cancers and premature skin aging is being pointed out by the results of our study which confirms the data found in literature. The results of this study show an increased interest of patients with high education about prophylaxis, skin cancers and other solar dermatitis through their addressability to the specialist in a high number when compared with people with a low level of education. Another relevant aspect of our study is the increased interest of young patients when compared to older patients, about maintaining a good health condition of their skin and the prevention of UV radiation effects upon it, the protection means available and the latest information in this field. Avoiding exaggerated sun exposure, especially for children, and the use of all prophylaxis and protection methods has been recently mentioned in the European Code Against Cancer, elaborated by IARC (International Agency for Research on Cancer) as main methods of prevention and lowering skin cancer incidence. In this context, the

pharmaceutical industry has launched a large variation of photo protecting dermatological products aimed at protecting the skin and preventing skin cancers or other solar dermatitis. These photo protecting products have a very complex composition and are destined for all types of skins, be it normal, dry, fat, sensible or allergic to sun exposure, with high protection from UVA, UVB, infrared A radiations or pollution. For the sensible skin of babies and children there are special products available specially designed. Photo protection products are usable by all skin phototypes depending on the protection factor they contain. The use of photo protective means can prevent acute reactions caused by the sun, especially for skin phototypes I and II as shown by this study and confirmed by literature data. Persons with skin phototypes I and II have not suffered from actinic erythema and sun burns because of skin photo protection, compared with subjects which presented severe sun burns due to lack of photo protection of the skin, in a percentage of 41.20%. It is relevant to note the high number of persons, 26 with ages above 48 and 50 years, which have been identified to have actinic keratosis and skin cancers, meaning a 22.41% percentage of the total 116 subjects of the study; mainly because of chronic prolonged sun exposure without the use of any type of photo protection methods.

It is also relevant the fact that these persons belong to the I and II skin phototypes which demonstrates yet again the increased risk of developing skin tumors in these phototypes. Clinical and dermatological aspects of premature photo aged skin was shown at 26.70% of the subjects from the 40-49 group age ad especially in the age group above 50 years old, most of which were coming from rural environment and were working a large amount of time outside.

Therefore for the prevention of solar dermatitis, premature photo induced skin aging and especially skin cancers, it is recommended to avoid exaggerated sun exposure and the use of prevention and solar protection methods, especially for children and persons with skin phototypes I and II, which have a high risk of developing skin cancer. These are rounded up by periodical medical consults from the dermatology expert, by examining the entire skin area in order to detect early skin cancers, and their treatment where it is necessary. Sanitary education of population plays an important role in the prevention of these afflictions.

CONCLUSIONS

- 1) Solar radiations cause at normal skin level a series of acute solar dermatitis through exaggerated short term exposure, and skin cancers with premature skin aging following prolonged, chronic and cumulative exposure;

- 2) Children and people with skin phototypes I and II which are photo sensible have a higher risk in developing solar dermatitis and especially skin cancers;
- 3) The importance of prophylaxis and solar protection through the use of all means and solar protection products for the purpose of preventing all these afflictions, especially skin cancers;
- 4) Increased incidence of skin cancers in rural areas compared with urban ones;
- 5) The use of prevention and solar protection methods is seen much more at young people with a higher educational level compared with elderly and lower educational level;
- 6) Increased addressability to the doctor of persons from the urban areas compared with rural areas;
- 7) The importance of dermatological medical exam for the purpose of early detection of skin cancers and counseling of people with high risk of developing these.

REFERENCES

1. Anghel A., 2018, Aspecte Epidemiologice Histopatologice si Clinico-evolutive ale carcinoamelor cutanate, JURMED, Jurnal de Sanatate – Dermatologie, 2018
2. Coltoiu A., 1986, Tratat de Dermato-Venerologie Vol I Parea I, Editura Medicala, Bucuresti
3. Dumitrescu A., 1997, Dermatologie, Editura National, Bucuresti
4. Dumitru Justin C. Diaconu, Coman O.A., Benea V., 2002, Tratat de Terapeutica Dermato-Venerologica, Editura Viata Medicala Romaneasca, Bucuresti
5. Dumitru Justin C. Diaconu, Mihaela Anca Popescu, Dana Nica, Cornelia-Cristina Fratea, 1999, Dermato-Venerologie, Editura Didactica si Pedagogica, Bucuresti
6. Forsea Ana Maria, Actualitati in preventia si depistarea precoce a cancerelor cutanate, Revista Dermatologia in an centenar, Medica Academica, 2018
7. Gandini S, Sera F., Cattaruzza MS, Pasquini P., Zanetti R, Masin C, et. al, Meta-Analysis of Risk Factors For Cutaneous Melanoma: Family History, Actinic Damage and Phenotypic Factors, European Journal for Cancer;
8. Goldsmith LA & Colab, 2012, Fitzpatrick's Dermatology in General Medicine 8th Edition, New York NY, Mc. Graw-Hill
9. Klas Wolff, Richard A. Johnson, Arturo P. Saavedra, 2017, Fitzpatrick Atlas Color si Compendiu de Dermatologie Clinica, Editura Medicala Callisto, Bucuresti
10. Popovici A., 1982, Dermatofarmacie si Cosmetologie, Editura Medicala, Bucuresti
11. Tolea I., 2000, Dermatovenerologie Clinica, Editura Scrisul Romanesc, Craiova
12. Vulcan P., Wolfshaut A., Bogdan,C., 1985, Dermatozele varstnicului, Editura Medicala, Bucuresti