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Sunburn

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Introduction

Sunburn is a radiation burn to the skin caused by too much exposure to the sun's ultraviolet (UV) rays or artificial sources such as tanning beds. The biggest risk factors for sunburn is the amount of time the skin is exposed to UV rays, plus the intensity. Many factors such as time of day, medications, ozone depletion, high altitude, clear skies, and skin phototypes influence sunburns. An increase in the number of sunburns someone obtains is directly related to an increase in the risk of skin cancer. Therefore, by fully understanding the cause, treatment, and prevention of sunburns, patients can drastically decrease their risk of skin cancers. This will improve their quality of life. Additionally, by preventing sunburn, patients can reduce the solar effects of aging, which can lead to better cosmetic results.

Etiology

Sunburn is caused by too much exposure to the ultraviolet radiation from the sun or similar artificial sources such as tanning beds. Many factors contribute to facility and severity of sunburn:

1. *Medications*: Sunburn risk is increased by tetracyclines (especially doxycycline), thiazide diuretics, sulfonamides, fluoroquinolones, nonsteroidal anti-inflammatory drugs, retinoids, and St. John's wort amongst other photosensitizing medication [1].
2. *Increased UV index*:
 3.
 - The time between 10 am and 4 pm is when the sun's rays are at their strongest.
 - Decreased cloud coverage corresponds with increased exposure to stronger UV rays.
 - Higher altitudes are correlated with an increased risk of sunburn due to a smaller layer of the earth's atmospheric protection.
 - Proximity to the equator is correlated with more direct UV ray exposure.
4. *Ozone depletion*: Certain areas of the world have decreased ozone or holes in the ozone layer. This equates to increased penetrance of the sun's UV rays.
5. *Fitzpatrick skin phototype*: Please see epidemiology for more information. The lighter the skin color, the easier it is to sunburn.
6. *Tanning*: Tanning or spending increased amounts of time in the sun to acquire darker skin, has been a popular American pastime for decades. Tanning increases the risk of skin cancers and accelerated skin aging. Rapid tanning may cause sunburn.

Epidemiology

According to a cross-sectional study using a nationally representative sample of 31,162 US adults from the 2015 National Health Interview Survey, 34% of respondents reported having at least 1 sunburn in 2015. Prevalence was highest among Fitzpatrick skin types I to III, those in younger age groups (adults 18 to 29 years old), and non-Hispanic white individuals. Additionally, individuals who used tanning lotions, engaged in physical activity, binge drink, and

are overweight were also more likely to get sunburned.[2]

Fitzpatrick's Skin Phototypes

- *Type I*: Pale white skin, burns easily, does not tan
- *Type II*: White skin, burns easily, tans with difficulty
- *Type III*: White skin, may burn but tans easily
- *Type IV*: Light brown/olive skin, hardly burns, tans easily
- *Type V*: Brown skin, usually does not burn, tans easily
- *Type VI*: Black skin, very unlikely to burn, becomes darker with UV radiation exposure[3]

As mentioned above, individuals with Type I to III Fitzpatrick skin phototypes were at increased risk for sunburn. This is due to decreased melanin pigment in the skin that blocks UV radiation. People with a lower Fitzpatrick skin phototype have a lower MED, or minimal erythema dose, the amount of UV radiation measured in energy per unit area that leads to erythema of non-diseased skin.[4][5]

Pathophysiology

UVA and UVB rays both play a role in sunburn, though UVB rays are responsible for directly damaging DNA by inducing the formation of thymine-thymine cyclobutane dimers.[6] When these dimers are formed, the body generates a DNA repair response, which includes the induction of apoptosis of cells and the release of inflammatory markers such as prostaglandins, reactive oxygen species, and bradykinin.[7] This leads to vasodilation, edema, and pain which translates into the classically red, painful skin seen in a sunburn. Additionally, skin exposure to UVB causes an increase in chemokines such as CXCL5 and activates peripheral nociceptors, which results in over-activation of the pain receptors of the skin.[8][9]

Histopathology

There are major changes that occur at all levels of the skin that characterize the histology of sunburn, particularly in the epidermis and dermis. In the epidermis, loss of Langerhans cells and vacuolated keratinocytes were noted in sunburned skin cells. The dermis experienced vascular changes that could be seen within thirty minutes of exposure to radiation that included enlargement of endothelial cells and edema caused by mast cell degranulation. Histamine and prostaglandin E2 levels rose 4-fold after the exposure of UV radiation, providing evidence that histamine plays a role in a sunburn reaction of the skin. This was all reversed after 24 hours from the exposure of UV radiation.[10]

History and Physical

The history surrounding sunburn typically involves excessive exposure to the sun without sufficient protection. Most patients will state that they either forgot to apply sunscreen, forgot to reapply, did not expect to be out in the sun as long as they were, or did not wear sun-protective clothing.

On physical examination, there will be various degrees of erythema and pain that are directly proportional to the severity of sun exposure. There may be areas of skin that are unaffected, particularly those covered up by bathing suits, hats, sunglasses, and other protective clothing. Skin may feel warm to the touch, edematous, or pruritic. If the sunburn is severe, patients may experience systemic symptoms such as nausea, fevers, and chills. If blisters are present, it may indicate a deeper, partial thickness burn.

Treatment / Management

The majority of sunburns will heal on their own without any further intervention. However, patients can take the following steps to treat their sunburns:

- Avoid the sun to avoid further skin damage
- Use Non-steroidal anti-inflammatories to decrease pain

- Drink plenty of water to avoid dehydration
- Apply topical creams such as aloe vera or hydrocortisone cream while avoiding local anesthetic creams
- Cool colloidal oatmeal baths may help soothe the skin

If a patient presents with a severe sunburn that leads to large areas of blistering and massive fluid loss with electrolyte imbalances, the use of the Parkland formula for rehydration is indicated. Additionally, the patient should be transferred to a burn unit where specialty care can be provided.

- $4 \text{ mL} \times (\text{body surface area } \%) \times \text{weight (kg)} = \text{volume of Ringer's lactate}$
- Administer one-half of the solution for the first 8 hours. Give the remaining half for the next 16 hours.

Differential Diagnosis

The differential diagnosis for sunburn includes:

- *Autoimmune diseases*: Systemic lupus erythematosus, dermatomyositis
- *Infections*: Staphylococcal scalded skin syndrome, cellulitis, erysipelas
- *Idiopathic*: Pityriasis rubra pilaris
- *Malignancies*: Sezary syndrome, other cutaneous lymphomas, a cutaneous manifestation of internal malignancy
- *Common dermatologic diseases*: Rosacea, acne, stasis dermatitis, seborrheic dermatitis
- *Solar reactions*: Solar urticaria, phytophotodermatitis, photoallergic type IV sensitivity reactions, phototoxic reactions
- *Congenital*: Ichthyotic conditions

Pearls and Other Issues

Sunburns can range from mild to severe based on the degree of exposure to the sun's ultraviolet rays. Prevention is easy and straightforward. A broad-spectrum sunscreen with SPF of at least 30 should be applied 30 minutes before sun exposure and every 90 minutes, after that. Water resistant sunscreen should be considered and frequently reapplied when spending time in the water. Sun protective clothing should be worn as an added barrier. Direct exposure to the sun should be avoided between the hours of 10 AM and 4 PM.

Enhancing Healthcare Team Outcomes

Having a sunburn is a benign condition that usually heals without further medical intervention. However, an increase in sunburn is directly related to an increase in skin cancer. Medical professionals that include nurses and pharmacists should take the time to educate patients on proper sun protection to help decrease the incidence of sunburn, and therefore decrease the risk of skin cancer. Patients who have acquired many blistering sunburns in the past would benefit from a referral to a dermatologist for yearly skin exams.

Occasionally, a sunburn is severe enough to warrant an inpatient admission to a hospital. This includes blistering sunburns that lead to fluid losses and electrolyte imbalances. These patients will require intravenous rehydration with lactated Ringer's and may benefit from a transfer to a burn center.

Continuing Education / Review Questions

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Figures



Sunburn. Contributed by DermNetNZ



Acute sunburn reaction in young child with erythropoietic protoporphyria. Contributed by DermNetNZ

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