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Basal Cell Carcinoma—A Preventable Disease

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Introduction
Basal cell carcinoma (BCC) is a non-melanoma skin cancer. According to the Skin Cancer Foundation, “BCC is the most frequently occurring form of all skin cancers. More than one out of every three new cancers is BCC, and the vast majority are BCCs” (www.skincancer.org). The American Academy of Dermatology lists BCC as one of the main risk factors in developing a BCC. Basaloid cells are a lighter skin color at a higher risk of developing a BCC than those with darker skin.

Signs and Symptoms
Patients should be on the lookout for a lesion that looks like a pimple, but does not go away. Any lesion that lingers for over a month should bring a visit to a dermatologist. Any lesion that gets larger or changes over a month should be treated. BCCs are typically found on sun-exposed areas such as the face, scalp, neck, ears and even the hands (Thompson, 2015). The appearance of BCC is most common “a pear-like, pink to white, dome shaped pimple with prominent telangiectatic surface vessels that develop as the lesion changes” (thembere, 2012, p.14). Telangiectases can be appreciated using dermoscopy (D’Orazio et al., 2013).

Pathophysiology
Basal cell carcinoma arises in basal keratinocytes found in the epidermis, exocrine sweat ducts, and hair follicles (Thembere, 2012). These cells “have high levels of apurinic-apyrimidinic lesions, which may be important” (Kapfer, et al., 2012, p.1223). UV rays are considered to be a carcinogen. In basal cell carcinoma, the keratinocytes are able to retain these normal, metaplastic and neoplastic changes (D’Orazio et al., 2013, p.1223).

Effects of Ultraviolet (UV) Rays
UV radiation is considered to be a “carcinogen” because of its ability to cause a “double-stranded DNA” and the non-specific damage agent (D’Orazio & et al., 2013). Properties of a tumor initiator and tumor promoter are found in ultraviolet light and excessive exposure can lead to “potential health risks, including atrophy, pigmentation changes, wrinkling, and melanoma” (D’Orazio, et al., 2013, p.1223).

One’s skin tone is determined by how much melanin is produced by the body. Keratinocytes found abundantly in the epidermis accumulate melanin pigment as they are maturing. The epidermal melanin functions to block UV rays penetrating the skin (D’Orazio et al., 2013). According to D’Orazio, et al., “melanin exists in two main chemical forms: (1) eumelanin, a dark pigment expressed abundantly in the skin of heavily pigmented individuals, and (2) pheomelanin, a light-colored sulfated pigment resulting form incorporation of cyanoacetal into melanin precursors” (2013, p.1223). The main determinant of skin complexity and sensitivity to UV rays is the amount of melanin (“natural sunscreen”) in the skin along with the type of melanin found in the skin (D’Orazio et al., 2013). UV rays are separated into UV-A, UV-B, and UV-C. These classification is based on different wavelengths and energy levels. UV-A is mainly absorbed by the atmosphere, so only UV-A and UV-B are absorbed by the skin. The dermis absorbs UV-A rays, and UV-B is absorbed by the epidermis (D’Orazio et al., 2013, p.1223).

Once a threshold has been exceeded, the basal keratinocytes activate apoptotic pathways. The key players and the pathway are discussed (D’Orazio et al., 2013). Damage to keratinocytes activates response pathways as cell death activation pathway to keratinocyte apoptosis occurs when abnormal (D’Orazio & et al., 2013). “Basaloid cells are two or more major histologic patterns” (D’Orazio et al., 2013, p.1223).

Several hours after exposure, damage response signals diminish, and keratinocytes accumulate causing thickening of the epidermis in order to protect against future UV rays (D’Orazio et al., 2013). Mutations from UV rays generate reactive oxygen species (ROS). ROS can cause mispairings of nucleotide bases resulting in mutations that can be carcinogenic” (D’Orazio et al., 2013, p.1223).

Nucleotide base pairings in DNA are directly affected by UV rays. Keratinocytes are the amount of melanin (“natural sunscreen”) in the skin along with the type of melanin found in the skin (D’Orazio et al., 2013). UV rays are separated into UV-A, UV-B, and UV-C. These classification is based on different wavelengths and energy levels. UV-A is mainly absorbed by the atmosphere, so only UV-A and UV-B are absorbed by the skin. The dermis absorbs UV-A rays, and UV-B is absorbed by the epidermis (D’Orazio et al., 2013, p.1223).

UV-induced photoreactions (induction of photoreceptors such as cAMP) and transderivatization reactions occur, and transderivatization is prevented by cAMP (D’Orazio et al., 2013, p.1223).

The hedgehog pathway is caused by the release of a signaling molecule called sonic hedgehog (D’Orazio et al., 2013, p.1223).

Melanocytic 1 receptor
The melanocytic 1 receptor (MC1R) is a critical genetic locus involved in pigmentation, the adaptive tanning response and skin cancer susceptibility. MC1R is found on the surface of melanocytes where it binds to alpha-melanocyte stimulating hormone (aMSH) and transmits differentiation signals into the cells through activation of adenylyl cyclase and generation of cAMP. Some MC1R receptors are thought to be “characteristic transition mutations” (D’Orazio et al., 2013, p.1223). In the absence of one or more of these “characteristic transition mutations,” the immune system does not recognize the melanocytes for “t” (Kasper et al., 2012, p.162).

MC1R polymorphisms are commonly found in individuals with a darker skin tone. “Loss of signaling MC1R alleles are associated with up to a four-fold increased lifetime risk of melanoma and other skin cancers” (D’Orazio et al., 2013, p.1223).

In fair-skinned, sun-sensitive and skin cancer prone populations, loss-of-signaling MC1R polymorphisms are commonly found (D’Orazio et al., 2013, p.1223). “Loss of signaling MC1R alleles are associated with up to a four-fold increased lifetime risk of melanoma and other skin cancers” (D’Orazio et al., 2013, p.1223).

Significance
Basal cell carcinoma is a type of cancer that is preventable. While there is no known cure for basal cell carcinoma, there are preventative measures that can be taken. With proper education, anyone can prevent this disease from occurring.

Conclusion
There is an epidemic of skin cancer in our society. The obsession with getting a tan is setting up society for future health issues that could have been easily prevented. It is important to teach individuals good sun protection practices at a young age, but it is even more important for individuals to start taking their skin better with proper education. With proper education, hopefully the majority of these diagnosed with basal cell carcinoma will rapidly decrease.

Implications for Nursing
For healthcare professionals, it is imperative to educate patients on the dangers of unprotected sun exposure. “Roughly 1 in 5 Americans will develop skin cancer in their lifetime” (D’Orazio et al., 2013, p.1223). Sun exposure is not the only thing that individuals should be educated on, healthcare professionals should also educate patients on the danger of using tanning beds.

Research shows that people who are more likely to use tanning products also use more protection (Thompson et al., 2013, p.1223). By using proper protection, it can be shown that “the risk of developing melanoma caused by tanning products is significantly low” (D’Orazio et al., 2013, p.1223).

The obsession with getting a tan is setting up society for future health issues that could have been easily prevented. It is important to teach individuals good sun protection practices at a young age, but it is even more important for individuals to start taking their skin better with proper education. With proper education, hopefully the majority of these diagnosed with basal cell carcinoma will rapidly decrease.

Additional Sources


References


Genetics & the Hedgehog (Hh) pathway
Since there are different appearances of BCC, it is thought that the cell of origin could contribute to the pathologic condition (Kapfer et al., 2012). Stem and progenitor cells are thought to be the most probable sources of tumor initiation due to their longevity and ability to self-renew (Kapfer et al., 2012, p.456). In basal cell carcinomas, the hedgehog (Hh) pathway seems to be impaired. The hedgehog pathway is crucial for transmitting information and plays a role in embryonic development, but also plays a role in adults as well (medical-dictionary.thefreedictionary.com). With the impairment of the Hh pathway, this could explain why the immune system does not take care of the carcinomas cells when they first develop.

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Figure 2 – Diagram of UV rays hitting the skin (D’Orazio, et al., 2013)