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Skin cancer concerns particular to women[☆]Z. Al-Dujaili^{a,b}, M. Henry^{a,c}, A.S. Dorizas^d, N.S. Sadick^{a,c,*}^a Sadick Dermatology, New York, NY^b New York-Presbyterian Hospital, New York, NY^c Department of Dermatology, Weill Cornell Medical College, New York, NY^d Department of Dermatology, University at Buffalo, NY

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ABSTRACT

Background: Skin cancer has reached epidemic proportions, with more new cases diagnosed annually than the combined incidence of cancers of the breast, prostate, lung, and colon. Estimates show 2 to 3 million new cases of non-melanoma skin cancer (NMSC) every year, and, among women, it is the young (younger than 45 years) who are disproportionately affected.

Objective: This article aims to address questions and concerns pertinent to skin cancer in a woman-centric way. An updated landscape of causative factors, the latest detection/treatment methods, and ultimately the preventative measures available to them are described.

Methods: A broad literature search was conducted using the PubMed database with search terms focusing on female gender. Additional articles were identified from cited references.

Conclusions: The published findings on causation of melanoma skin cancer and non-melanoma skin cancer in females are outlined, as well as current detection methods and treatment options. Furthermore, a variety of preventative measures specific to women that can reduce the chance of being diagnosed with skin cancer are discussed.

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Epidemiology

Skin cancer has reached epidemic proportions, with more new cases diagnosed annually than the combined incidence of cancers of the breast, prostate, lung, and colon. Estimates show 2 to 3 million new cases of non-melanoma skin cancer (NMSC) every year, and among women, it is those younger than 45 years who are disproportionately affected. Furthermore, there are increasing rates of melanoma in women before the age of 45 years (Simoes et al., 2015). Although diagnosis and treatment of skin cancer has negative psychological effects to any individual, studies show that women are affected more than men, especially young, single women who are particularly concerned about their health and appearance during this time in their life (Giese-Davis et al., 2012). High stress, poor quality of life, body image dissatisfaction, and fear of recurrence are among the ramifications experienced by women who receive a diagnosis of melanoma or non-melanoma skin cancer (Al-Shakhli et al., 2006; Atkinson et al., 2013; Radiotis et al., 2014).

This report aims to address questions and concerns pertinent to skin cancer in women. An updated landscape of causative factors, the latest detection/treatment methods, and ultimately the preventative measures available are described.

Causative factors

Multiple endogenous (fair skin, family history cancer, presence of skin dysplasia, genetic background) and exogenous (exposure to ultraviolet [UV] light, both intermittent and cumulative) factors are known to confer skin cancer susceptibility. Melanoma risk is predominantly associated with sun exposure in early life, whereas NMSC is associated with sun exposure in both adulthood and early life (Wu et al., 2014). While white, pale skin used to be associated with affluence and physical health, at the turn of the 20th century, a new medical paradigm focusing on the therapeutic benefits of sunlight, along with social and cultural changes such as paid vacation, outdoor activities, and fashion trends, ignited a shift in sun-exposure attitudes (Randle, 1997). Swimwear and sportswear for women increased body exposure from 18% to 47%; the invention of the bikini increased body exposure to almost 92% and tan skin was promoted in women's fashion media as highly desirable.

The surge in indoor tanning centers in the 1980s directly led to a dramatic increase of overall UV exposure. The most frequent patrons, white female adolescents of higher socioeconomic status, provided this population with an additional source of UV radiation besides outdoor exposure, and thus an increased risk of skin cancer (Hausauer et al., 2011).

Other lifestyle factors associated with skin cancer risk in women are use of tobacco and alcohol, as research has shown smoking and high alcohol consumption, especially white wine and liquor, are related to developing NMSC (Kubo et al., 2014; Rollison et al., 2012). Although it

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has yet to be evaluated, it is plausible that personal care products, from deodorants to creams and makeup that come in contact with a woman's skin, can pose a potential risk in the development of skin cancer. The cosmetic industry uses thousands of synthetic chemicals, but the Food and Drug Administration (FDA) only regulates the colors that can be used in hair dyes. Some of the common constituents found in cosmetics, such as parabens, benzophenone-3, and phthalates, are known endocrine disruptors and have been associated with the development of breast cancer. Parabens can interact with estrogen receptors, potentiate UV-induced damage, and have been suspected to lead to the development of melanocytic lesions (Darbre and Harvey, 2008; Dewalque et al., 2014).

Detection and treatment

Early detection of skin cancer unequivocally improves prognosis, promotes survival, and reduces the burden of stressful treatment procedures. Patients, through self-screening, can be the first to detect suspicious skin lesions (Rigel et al., 2010). As women pay particular attention to the health of their skin, especially the face and extremities that are the most common anatomical sites of skin cancer manifestation, they have a greater probability of self-detecting skin anomalies (Chevalier et al., 2014; Lee et al., 2014). Women tend to be more open and communicative about voicing their health concerns, and throughout their lives tend to have more contact with health professionals. Women frequent beauty salons more than men, where aestheticians, hairstylists, and massage therapists may contribute to discovering skin anomalies (Glithro et al., 2015). Women also are generally more aware of the risk factors associated with skin cancer and proper sun protection guidelines, as shown by a recent survey conducted by the National Skin Cancer Foundation (PR Newswire, 2012). This increased awareness is coupled with the proper know-how when performing self-examinations and searching for suspicious lesions.

Along with patient and physician screens, diagnostic technologies have dramatically improved, facilitating early disease detection. The gold standard of skin cancer diagnosis is biopsy followed by histopathological examination (Simoes et al., 2015). The discomfort, potential scarring, and invasiveness of this procedure are distressing, especially for young women. Dermatoscopy, total body photography (TBP), confocal microscopy, multispectral devices (SIAscope, MelaFind), diagnostic ultrasound, mRNA analysis of tape-stripped epidermal stages, and even smartphone apps are few of the new non-invasive, painless technologies that may reduce unnecessary biopsies (Mayer et al., 2014). The diagnostic efficacy is still under study for most of these new tools, and there are barriers to their adoption, such as cost, physician training, and insurance coverage.

While eradicating the cancer is at the forefront of a woman's expectations during treatment, minimizing scarring and other aesthetic concerns should be taken into consideration. Surgical modalities have been the mainstay treatment option, with excision biopsy being the gold standard (Simoes et al., 2015). Superficial ablative techniques such as electro-desiccation and curettage or cryotherapy are used primarily for low-risk NMSC tumors, whereas full-thickness techniques such as Mohs micrographic surgery, excision surgery, and radiotherapy are used to treat high-risk NMSC tumors.

The standard of care for melanoma is surgical excision. Women presenting with tumors on cosmetically critical sites, such as the lips, nose, cheek, or eyelid regions, can be successfully treated with a new technology based on a variation of Mohs surgery that provides the highest cure rate and creates the smallest surgical defect. The procedure uses an anti-melanoma targeted antibody known as MART-1 (melanoma antigen recognized by T cells), which improves the speed and accuracy of the procedure and allows the surgeon to microscopically identify and remove the melanoma cells with minimal sacrifice of healthy tissues in real-time. The precision of this technique is critical when working on delicate structures such as an eyelid (Lee et al., 2014).

Common concerns among women are how treatment of skin cancer will interfere with family planning and even pregnancy, as many women are delaying pregnancy until their 30s or 40s and the incidence of skin cancer diagnosis during a woman's child-bearing years has increased (Melanoma and pregnancy, 2009). For thin, less than 1 mm, early stage-type tumors, there is good prognosis with low cancer recurrence, thus a woman does not need to delay getting pregnant. For woman with a history of a thicker skin tumors, the prognosis is unclear; thus, they are advised to leave a 2 to 3 year gap before pregnancy, as that is the most common time for the disease to recur (Peccatori et al., 2013; Pentheroudakis et al., 2010). If diagnosis occurs during pregnancy, a body of evidence based on six case-control studies and two large population-based studies found that, apart from creating distress, treating the disease is safe and does not pose any threat to the fetus, with the exception of rare cases of advanced melanoma (Beccatori et al.; Pentheroudakis et al.). Local excision of a tumor can be safely performed under local anesthesia during pregnancy with concomitant fetal monitoring; for thicker tumors, sentinel lymph node mapping and biopsy should be considered (Davis et al., 2014).

The future of skin cancer treatment is also very promising, with innovative minimally or non-invasive approaches emerging to address even the most challenging of cases. Five drugs have gained FDA approval for the treatment of advanced melanoma, with approval of several others anticipated in the near future (Lo and Fisher, 2014). Along with molecular drug discovery, technological advances in the drug carrier system are underway, which will permit a localized and controlled drug release while ensuring minimal systemic damage and maximal sparing of healthy tissue. Investigational strategies include nanoparticles, liposomes, cell-penetrating peptides (CPPs), and stem cells (Simoes et al., 2015).

Prevention methods

A variety of preventative measures specific to women can significantly reduce their chance of being diagnosed with skin cancer. Rigorous use of broad-spectrum (UVA/UVB) sunscreen with an SPF of 15 or higher, seeking the shade when outdoors, and protective clothing should be incorporated as part of an everyday routine for both men and women. Women are the biggest consumers of beauty products, and although many brands integrate a built-in sun-protection factor in their cosmetic products, it should be emphatically stressed that this cannot substitute use of sunscreen because the sun-protection strength of cosmetics is often considerably weaker. For women pursuing a "healthy glow," the American Academy of Dermatology recommends self-tanning products as an alternative to tanning in UV light from the sun or indoor tanning. Although the majority of women who tan are aware that use of tanning beds poses an increased skin cancer risk, they are still heavily used (Petit et al., 2014). Studies have demonstrated that tanning beds have addictive potential and that women are more likely to be addicted, with the greatest tendencies occurring among white women younger than 50 years; psychological counseling and/or medication interventions to address the reasons underlying this compulsive behavior may be the best skin cancer preventative strategy in these cases. Public measures can also halt the use and accessibility of indoor tanning beds. Most states have some artificial tanning restrictions in place for minors. Furthermore, the fashion world, too, has joined these preventative efforts, as seen in the prohibition of tanning in models in the 2012 Fashion Weeks in London, England, and New York, New York (Chang et al., 2014).

Healthy lifestyle changes, such as limiting smoking and alcohol consumption and following a diet that is rich in dietary antioxidants and phytochemicals in the form of whole foods, particularly fruits and vegetables, has been associated with reduction of some forms of skin cancer in women, and as such should be recommended as a preventative strategy (Lo and Fisher, 2014). Supplementation of aspirin and vitamin D, which was shown to significantly counter the risk of skin cancer in

postmenopausal women, may also be an appropriate approach (Chang et al., 2014; Petit et al., 2014).

Although skin is the most common site of cancer, its malignancies are likely to be among the most preventable. Public and individual health initiatives targeting skin cancer reduction are showing promising positive results. According to the latest figures of the American Cancer Society, despite the alarming rise of incidence rates over the past 30 years, trends appear to have plateaued in the younger women (Hery et al., 2010). Health and fitness magazines are a popular medium for increasing exposure to health-related content, and as they are read monthly by millions of women of varied ages, they can adopt a more focused approach to informing women of skin cancer risks and relevant preventive measures (Basch et al., 2014; Cho et al., 2010). The mobile device revolution may also impact early detection and skin cancer prevention (Buller et al., 2015).

Prevention of skin cancer by clinical providers who have frequent surveillance opportunities with their female patients is a currently recognized practice gap. Time constraints during a patient–doctor visit and lack of confidence in the skin cancer examination are some of the barriers, and initiatives such as integrating instructional films during medical training are currently being tested for efficiency (Garg et al., 2014). Engagement of untapped resources in the community, such as beauty providers and other medical practitioners such as chiropractors, can also impact skin cancer prevention; initial data show that these providers are open and receptive to training to fulfill this role (Glithro et al., 2015; Roosta et al., 2012). Encouraging a uniform, worldwide consensus in prevention and early detection programs can further impact disease eradication in women and reduce the need for invasive, potentially disfiguring procedures.

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