

CLINICAL PRACTICE

A guide for dermatology nurses to assist in the early detection of skin cancer

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ABSTRACT

Early diagnosis of skin cancer, particularly melanoma, leads to improved morbidity and mortality. While nurses have been leaders in skin cancer awareness and education for decades, the nursing community can take a more active role in the fight against skin cancer. In order to assume this role, nurses must be familiar with diagnostic aids that help in the early recognition of skin cancer. Dermatology nurses facilitate care in the interdisciplinary team by focusing on patient centered outcomes. Nursing roles and responsibilities in the interdisciplinary team are vital to clinic pre-screening, improving public awareness, disseminating patient education, providing guidance regarding sun avoidance and protection, and providing education on the fundamentals of skin self-examinations and total body skin examinations. Nursing skin assessment requires knowledge of skin lesion morphology and biology, and pattern recognition. As the sensitivity and specificity of naked eye examinations are suboptimal, dermoscopy provides a method for improving and streamlining skin lesion triage and assessment. In this review, we discuss a multi-prong approach to the diagnosis of melanoma, including the ABCDE mnemonic, the “ugly duckling” concept, and some newer technologies (*e.g.*, dermoscopy and total body photography) that aid in the early detection of skin cancers. Familiarity with these detection aids can provide nurses with a basic framework to aid in diagnosing skin cancer.

Key Words: Dermoscopy, Nursing, Skin cancer, Diagnosis, Screening, Prevention triage amalgamated dermoscopic algorithm

1. INTRODUCTION

Skin cancer incidence rates continue to rise in the United States (US). In 2016, approximately 3.5 million non-melanoma skin cancers (NMSCs)^[1] and 76,380 melanomas will be diagnosed.^[2] Approximately, \$4.8 billion and \$3.3 billion were spent between 2007-2011 in the U.S. on treating melanoma and non-melanoma skin cancer, respectively. Despite increased public awareness and improved treatment modalities, approximately 13,000 people die each year in the US from skin cancer.^[3,4] To decrease both morbidity and mortality from skin cancer, efforts aimed at prevention and early diagnosis remain critical, as these strategies offer the best long-term outcomes for patients.

1.1 Nursing roles

Nurses play an integral role in the diagnosis and management of skin cancer. Traditionally, nurses have been leaders in creating educational programs aimed at skin cancer prevention and have provided education on risk factors and preventative measures. For example, nurses teach patients and their families on important safety measures related to ultraviolet radiation (UVR) avoidance, UVR protective clothing, skin self-examinations, and use of sunscreens.

Nurses also help ensure patient compliance with monthly skin self-examinations as well as interval skin cancer screening evaluations with healthcare providers. Increasingly, however, nurses are assuming a more direct role in skin cancer

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diagnosis, such as performing the initial evaluation and triage of skin lesions concerning to patients. In this regard, nurses must obtain an accurate and relevant patient history and be sufficiently confident and able to perform a skin examination.^[5,6]

Nurse-led basal cell carcinoma clinics have been developed in England in response to the increase of incidence rate of basal cell carcinomas where outpatient clinics are unable to handle the volume of patients in need of skin cancer evaluation. Nurse consultants perform skin cancer surveillance and are an integral part of the referral process to specialists.^[7]

Nurses are at the frontline of primary, secondary, and tertiary prevention, and the goal of skin cancer is prevention. By increasing awareness on the importance of skin assessment and skin cancer screening tools and techniques, nurses and nurse practitioners can improve early skin cancer detection.^[8,9] Nurses can improve their use of skin cancer screening tools and elevate their role in early detection of skin cancers.

1.2 Screening tools

Although the ABCDE mnemonic is helpful in identifying some melanomas, a significant subset of melanomas lack diagnostic criteria and escape early detection. The advent of dermoscopy, however, has significantly improved healthcare providers' ability to recognize skin cancer. Dermoscopy, also known as dermatoscopy, epiluminescence microscopy, incident light microscopy, or skin surface microscopy, is a non-invasive imaging technique that provides a horizontal view of the subsurface level of the skin with 10x magnification. It enables users to assess features in skin lesions that are not evident to the naked eye and increases both the diagnostic accuracy and confidence of clinicians assessing skin lesions.^[11-13]

Persons with questionable skin lesions may greatly benefit from dermoscopy as applied by trained nursing professionals, although few studies have investigated the use of dermoscopy by the nursing community. Oliveria *et al.* found that nurse practitioners trained in dermoscopy for skin cancer screening can accurately triage suspicious lesions and make fewer unnecessary specialty referrals.^[14] Roebuck *et al.* reported a lack of dermatologic training in medical students' and nurse practitioners' core curriculum and there is a need to improve assessment and use of screening tools in skin cancer prevention. Nurse practitioners are successful in applying evidence based care when prepared sufficiently.^[8,9] A survey conducted at the Dermatology Nurses' Association annual convention in 2007 reported that 83% of nurses performed total body skin examinations, but that only 34% used dermoscopy as a diagnostic aid during skin cancer screenings.^[15] This

manuscript provides a guide for use of screening tools and evaluation for early detection of skin cancer.

Given the favorable impact of dermoscopy on the early detection of skin cancer, a significant gap exists regarding the teaching and dissemination of dermoscopy to the nursing community. In order to improve the quality of skin cancer education in nursing curricula, nurses should receive increased exposure to and training in dermoscopy. Dermoscopy trained nurses can help with the early identification of skin cancers and play a vital role in improving skin cancer mortality with early diagnosis and appropriate referral.^[16]

In this review, we briefly summarize traditional clinical approaches for the diagnosis of skin cancer and provide a basic primer regarding the use of dermoscopy in skin cancer screening examinations, advocacy strategies and patient education. The combination of these components lends itself to an effective, multi-prong diagnostic approach that emphasizes analytical, differential, and comparative recognition processes (see Figure 1).^[17] Dermoscopy is a screening tool that can be utilized by nurses for the early recognition of skin cancer.^[8]

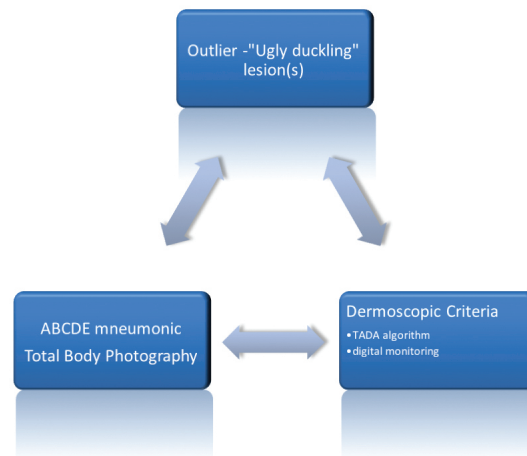


Figure 1. Multi-prong approach

2. ABCDE MNEMONIC

The thickness (or depth) of cutaneous melanomas is strongly associated with overall survival. Friedman *et al.* published the ABCD mnemonic (A = asymmetry, B = border irregularity, C = color variegation, D = diameter \geq 6mm) in 1985 as a clinical aid to enhance early melanoma detection.^[10] In 2004, the letter E (for evolving) was added to emphasize the dynamic nature of melanoma (see Figure 2).^[18] The ABCDE mnemonic has been widely used by the public and health care community over the past three decades.

The ABCDE mnemonic has a moderate to high accuracy in diagnosing melanoma when used by dermatologists.^[19]

In one study, the sensitivity for each criterion was found to be 57% (A), 57% (B), 65% (C), 90% (D) and 84% (E), respectively (19). The specificity was likewise high: 72% (A), 71% (B), 59% (C), 63% (D), and 90% (E).^[19] However, when only two criteria were present, the sensitivity and specificity were 89.3% and 65.3%, respectively, although when three criteria were present, the sensitivity was 65.5% but the specificity improved to 81%.^[19] Studies involving general practitioners and the use of the ABCDE criteria have shown improved specificity and sensitivity in detection of melanoma as compared to naked-eye examination^[17,18] and appropriate referral of suspicious lesions to dermatologists.^[20]

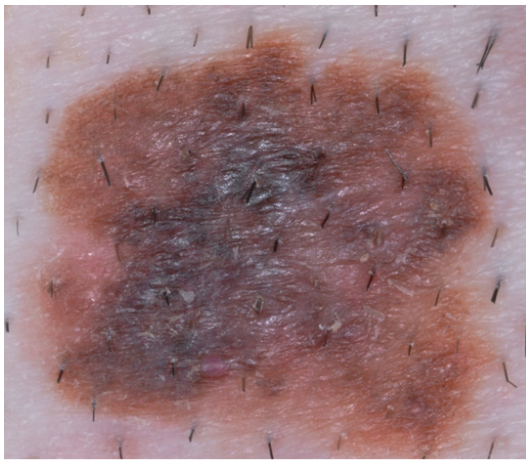


Figure 2. ABCDE mnemonic.

The ABCDE mnemonic is most useful for the recognition of pigmented superficial spreading melanomas. This 18 mm × 15 mm melanoma on the chest has asymmetry, border irregularity, color variegation, size > 6 mm, and a history of evolution.

A shortcoming of the ABCDE mnemonic is that the sensitivity and specificity are sub-optimal in the diagnosis of benign nevi. The “atypical” or “dysplastic” nevi frequently have one or more of the ABCDE criteria, leading to unnecessary biopsies. In addition, melanomas can be symmetric, smooth bordered, one color, smaller than 6 mm in diameter, or slowly changing over years, contrary to ABCDE criteria.^[23–25] Finally, patients do not always provide accurate information regarding the history of skin lesions. The methodology of gathering lesion history of change through patient reporting has drawbacks due to the variability in accuracy of patient self-reporting unless patients have taken a “selfie” of lesion(s) in question.

In 2015, Nijhawan *et al.* stressed importance of biopsy site “selfies” for site identification prior to surgical interventions with a dermatologic surgeon.^[26] Nurses should encourage patients to take “selfie” images of new and/or changing lesions during monthly self-skin examination. In

addition, smart phone applications are available and useful in self-monitoring lesions for changes and cataloging lesions. Computerized digital imaging systems (baseline images) and total body mole mapping photography can aid in correlation of patient reporting and clinical presentation of lesions.^[17] Total body/lesion photography improves lesion cataloging, captures visual lesion characteristics and helps in objective monitoring of lesions.

3. OUTLIER LESIONS

Many nevi share morphologic characteristics with melanoma, explaining why nearly 30 benign lesions are removed for every melanoma detected.^[27] In addition, some melanomas can be easily recognized but do not conform to the ABCDE criteria. In 1998, Grob and Bonerandi first introduced the concept of the “ugly duckling” sign,^[28] which originated from the observation that nevi from a single individual tend to resemble one another in morphology. The “ugly duckling” in any given person would therefore be a lesion that differs from their other nevi and may be indicative of melanoma (see Figure 3). The authors hypothesized that experienced dermatologists use this differential approach more or less unconsciously when evaluating skin lesions.



Figure 3. Ugly duckling sign.

On the back of this 43-year-old gentleman, one lesion (black arrow) appears different to the other pigmented lesions, which are nevi. Histopathologic examination of a skin biopsy of the lesion confirmed the diagnosis of invasive malignant melanoma.

Further studies have validated these observations and have found that dermatologists rely more heavily on differential recognition (*i.e.*, “ugly duckling” sign) than an analytical approach (*i.e.* ABCDE criteria) in the diagnosis of melanoma.^[29] Furthermore, in 2008, Gachon *et al.* found a sensitivity of the ugly duckling sign for melanoma detection

to be 90%; 100% for experts, 89% for general dermatologists, 88% for nurses, and 85% for non-clinicians.^[30] In addition, 100% of melanomas and only 3 of 140 benign lesions (2.1%) were apparent as “ugly duckling” lesions.^[30]

4. TOTAL BODY PHOTOGRAPHY

Total body photography (TBP) entails taking clinical images of the patient’s entire skin in order to detect macroscopic changes in skin lesions over time. This comparative approach is most often used in patients with hundreds of nevi or the atypical mole syndrome. During each clinic visit, the patient is systematically compared to their baseline images in order to facilitate the detection of new or changing skin lesions. Lesions that are stable in size, shape, and color are unlikely to be malignant. New or changing lesions warrant closer inspection to determine if additional monitoring or biopsy is indicated. Studies examining the impact of total body photography on melanoma detection have found that the use of this technology in skin cancer screening leads to detection of thin melanomas. There is a natural synergy that exists between TBP and dermoscopy where TBP aids in identification of new and changing lesions and dermoscopy provides an advantage in evaluating whether a biopsy is warranted.^[31–34]

5. DERMOSCOPY

5.1 Background

Dermoscopy allows the visualization of the subsurface morphology of skin lesions, including colors, structures, and patterns, not visible to the naked eye. These features provide additional diagnostic information that aids users in correctly identifying skin lesions. This technique has been shown to improve diagnostic accuracy for primary cutaneous melanoma^[13] and to decrease unnecessary biopsies of benign skin neoplasms,^[35,36] when compared to naked eye examination alone.

The dermatoscope is a handheld imaging device that is equipped with a magnifying lens (typically $\times 10$) and light source, and costs between several hundred to just over a thousand U.S. dollars, depending on the model and manufacturer (see Figure 4). There are two dermoscopic imaging modalities available: non-polarized and polarized dermoscopy. Non-polarized dermoscopy requires direct contact with the skin and a liquid medium, thereby replacing the normal skin-air interface with a skin-liquid-glass interface. As a result, there is decreased light reflection (*i.e.*, glare) from the skin surface, allowing the user to analyze structures present in the superficial layers of the epidermis and dermis. Different immersion liquids can be used, including water, oils, alcohols, or gels. It is important to eliminate air bubbles that can reduce imaging quality.^[37]



Figure 4. Dermatoscopes.

Numerous dermatoscopes are available today. These are examples of a few dermatoscopes in current use.

Polarized dermoscopy instead uses two polarizers with orthogonal axes to emit cross-polarized light. Cross-polarizing filters preferentially accept light from the deeper layers of the skin, allowing visualization of structures that may not be visible with non-polarized dermoscopy. The principal advantage of polarized dermoscopy is that it does not require skin contact or a liquid interface, allowing more rapid screening of skin lesions during examination. If a suspicious lesion is identified, direct contact and liquid interface can be used, which provides enhanced image clarity.^[38]

The differences between the principles and techniques of non-polarized and polarized dermoscopy lead to important differences in the structures and colors visualized with each technique. Table 1 describes the key differences in colors and structures between polarized and non-polarized dermoscopy. In reality, both dermoscopic techniques offer complementary information and knowledge of these differences can aid in distinguishing between benign and malignant skin lesions. Polarized dermoscopy may have higher sensitivity for skin cancer detection since blood vessels and white shiny structures, which are dermoscopic features important to the diagnosis of many skin cancers, are more conspicuous. On the other hand, non-polarized dermoscopy may improve specificity for certain skin neoplasm (*e.g.*, seborrheic keratosis) as more superficial skin structures are more easily identified.^[37,38] Toggling between polarized and non-polarized dermoscopy using newer generation, hybrid dermatoscopes facilitates identification of structures that may only be seen with one technique, which has been referred to as the “blink sign”.^[39] However, nurses need a lesion triaging system that will allow for identification of atypical findings with high sensitivity for skin cancer detection. With this in mind, the triage amalgamated dermoscopic algorithm (TADA) al-

gorithm may be ideal since the only modality needed for triaging lesions is the polarized setting.

Table 1. Key differences in structures and colors between non-polarized and polarized dermoscopy

	Nonpolarized Dermoscopy	Polarized Dermoscopy
Colors	Blue-white colors enhanced	Pink-red colors enhanced
	Color in blue nevi homogeneous	Blue nevi appears darker and have multiple hues
Structures	Milia-like cysts obvious	Milia-like cysts not as obvious
	Comedo-like openings obvious	Comedo-like openings not as obvious
	Regression structures such as peppering, blue-white areas, and gray color are more conspicuous	White scar-like areas more conspicuous
	Vascular structures less well visualized, particularly if too much pressure is applied during contact	Vascular structures more prominent
	Shiny white structures absent	Shiny white structures present

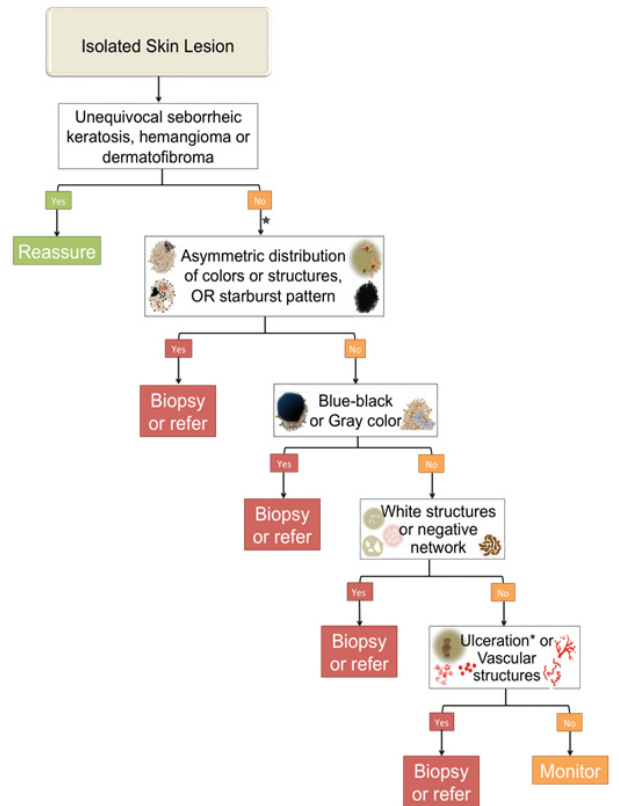
5.2 Triage amalgamated dermoscopic algorithm

TADA uses a multi-step approach to triaging skin lesions by improving on the short comings seen with existing algorithms such as the 3-point checklist, AC rule and prediction without pigment algorithms. This new algorithm includes evaluation for melanotic and amelanotic skin cancers, nodular melanomas and skin cancers without structures. The sensitivity and specificity of TADA for malignant (melanoma, BCC, SCC) skin lesions has been shown to be 94.8% and 72.3%, respectively.^[35]

Table 2. Dermoscopic structures in seborrheic keratosis, angioma, and dermatofibroma

	Dermoscopic structures
Seborrheic keratosis	Multiple (≥2) milia-like cysts, comedo-like opening, ridges and fissures, fingerprint-like structure, moth-eaten borders, hairpin vessels with white halo, sharp demarcation
Angioma	Red, blue, or black lacunae
Dermatofibroma	Ring-like globules, negative network, central white or pink scar-like, peripheral fine network, dotted vessels

In the TADA algorithm (see Figure 5), isolated skin lesions are first assessed for dermoscopic features found in seborrheic keratosis, angioma, and dermatofibroma (see Table 2, Figures 6-8). Lesions that do not have unequivocal features of these diagnoses are then assessed for (a) asymmetry in their distribution of colors or structures or (b) for the presence of a starburst pattern. If either is present, the lesion should be biopsied. Lesions without these features are then



* Algorithm is based on use of polarized dermoscopy
 * Ulceration without history of trauma
 Exceptions: 1) Any changing lesion in an adult patient
 2) Any volar lesion with a parallel ridge pattern
 Concept and design by Natalia Jaimes, MD and Ashfaq A. Marghoob, MD
 Triage Amalgamated Dermoscopic Algorithm (TADA)
 Front Updated 07/15

Triage Amalgamated Dermoscopic Algorithm (TADA)

- Asymmetric distribution of colors or structures, OR starburst pattern**
 Asymmetric (i.e., disorganized or chaotic) distribution of colors and/or structures
 Starburst-like pattern: Radial projections at the periphery of the lesion extending from the tumor toward the surrounding normal skin; may present as pseudopods or radial streamin
- Blue-black or Gray color**
 The presence of a blue-black color can aid in the diagnosis of symmetric nodular-pigmented melanomas. Gray color helps identify melanomas with regression and melanomas located on sun damaged skin.
 The presence of blue-black or gray color can be associated with structures such as blue-white veil, regression structures (i.e. scar-like areas, peppering or granularity), blue-gray globules, angulated lines, annular-granular pattern on face. The variations of these colors are determined by the density of melanin in the papillary dermis.
- White structures or negative network**
 Negative network: Serpiginous interconnecting hypopigmented lines that surround irregularly shaped pigmented structures resembling elongated, curvilinear globules
 Crystalline structures: Shiny, white linear streaks that are often oriented parallel or orthogonally to each other
 Rosettes: Four shiny, white points creating a pattern reminiscent of a four-leaf clover
 Blotches and strands: appear as larger and elongated structureless areas of shiny white color
 Keratin pearls/White circles: White to yellowish round structures surrounded by a white halo. Correlates with Horn pearls within the epidermis
- Ulceration or Vascular structures**
 Ulceration: complete or partial loss of epidermis and/or dermis or subcutaneous fat, without history of trauma
 Vascular structures include vessels of any morphology (i.e. arborizing vessels, dotted vessels, serpentine vessels, polymorphous vessels, corkscrew vessels, milky-red globules/vascular blush)

Figure 5. Triage Amalgamated Dermoscopic Algorithm (TADA)

assessed for blue-black or gray colors, white structures, neg-

ative network, ulcers/erosions, or vascular structures. If any of these features are identified, the lesion should be biopsied (see Figures 9-12).^[35]



Figure 6. Angioma: Note presence of red lacunae

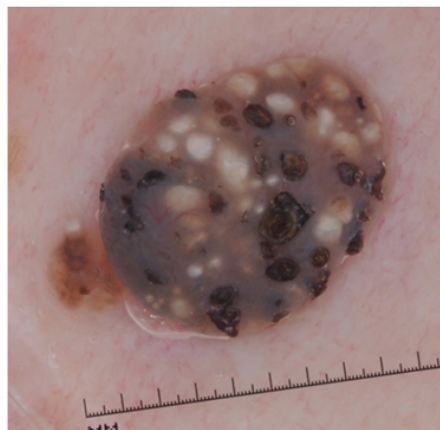


Figure 7. Seborrheic Keratosis: Note presence of milia-like cysts and comedo-like openings

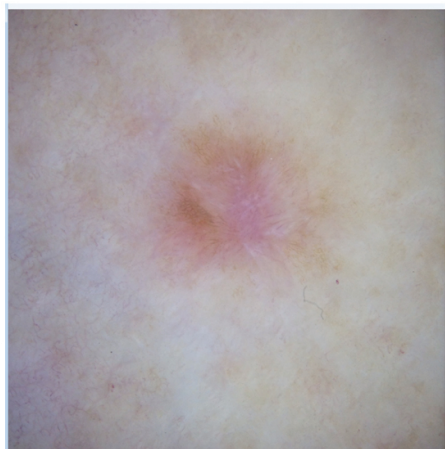


Figure 8. Dermatofibroma: Note presence of peripheral fine patchy network with central scar-like area, vascular blush, and shiny white structures

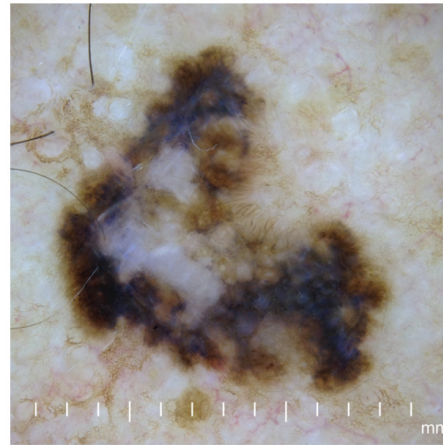


Figure 9. Melanoma detected using TADA algorithm. This lesion has no features for seborrheic keratosis, hemangioma, or dermatofibroma. It has an asymmetric distribution of colors and structures requiring a skin biopsy. Histopathologic examination confirmed malignant melanoma in situ.

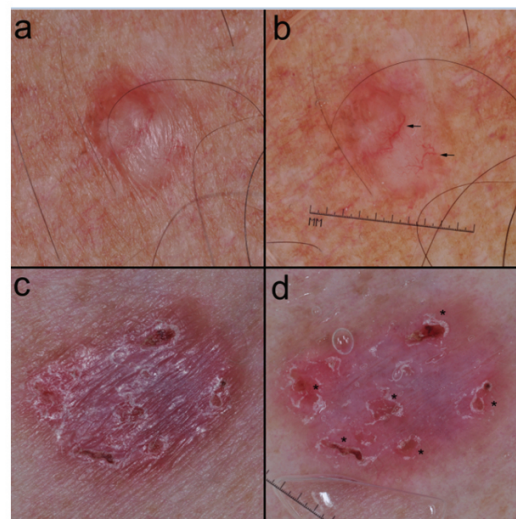


Figure 10. Basal cell carcinomas detected using TADA algorithm. Clinical (a,c) and non-polarized dermoscopic (b,d) images of basal cell carcinomas. The nodular basal cell carcinoma (a,b) has no features of seborrheic keratosis, angioma, or dermatofibroma. It has an asymmetric distribution of vessels (b, black arrows). The superficial basal cell carcinoma (c,d) similarly shows no features of seborrheic keratosis, angioma, or dermatofibroma. It has a symmetric distribution of colors and structures but also shows multiple ulcers/erosions (d, black asterisks).

5.3 Dermoscopy comparative approach

Similar to the concept of total body photography, sequential digital dermoscopic images of indeterminate skin lesions can be captured over time, allowing for “mole monitoring.” Typically, a baseline dermoscopic image is taken and a pa-

tient returns after either 3-4 months (short-term) or 6-12 months (long-term) evaluation. During the repeat examination, a new dermoscopic image is captured and the images are then compared side-by-side on a computer monitor to allow for detection of morphologic changes indicative of malignancy. This technique has been shown to reduce unnecessary excisions of benign lesions^[40] and to allow detection of melanomas that lack diagnostic clinical or dermoscopic features at baseline.^[41,42] Dermoscopic mole monitoring is used for flat non-palpable lesions only; raised lesions should never be monitored.

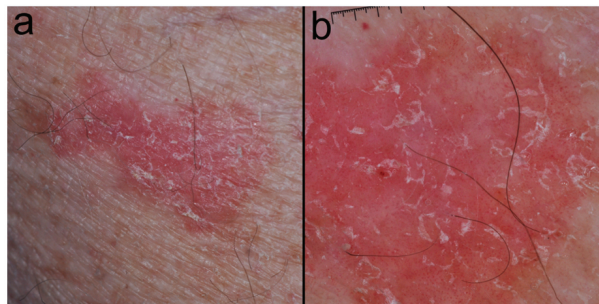


Figure 11. Squamous cell carcinoma detected using TADA algorithm: Clinical (a) and non-polarized dermoscopic (b) images of an in-situ squamous cell carcinoma. Note the presence of numerous vessels throughout the pink background

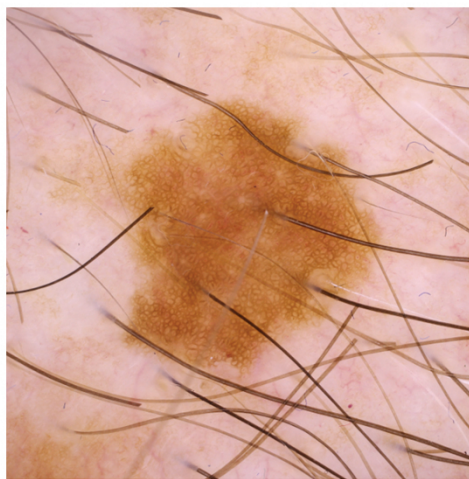


Figure 12. Nevus evaluated using TADA algorithm. Note: symmetry in pattern and colors. No biopsy is required.

5.4 Dermoscopy differential approach

As the dermoscopy field has evolved, expert dermoscopists have realized that the clinical “ugly duckling” sign is also relevant to dermoscopy. In patients with multiple nevi, for example, evaluation of skin lesions in the context of a patient’s other nevi results in a lower rate of biopsy of benign

lesions compared with evaluation of individual lesions based on morphologic structure alone.^[43] This concept has also been referred to as “moles breed true” in that individuals tend to harbor a limited number of dermoscopic patterns in their nevi.^[44] An extension of these observations is that any skin lesion with outlier dermoscopic features should be carefully examined.

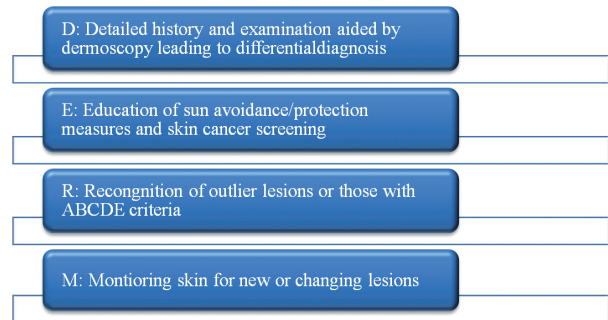


Figure 13. DERM mnemonic: A pathway to promoting the use of the multi-prong approach in an interdisciplinary setting is by utilizing the DERM mnemonic.

6. ROLE OF NURSING IN SKIN CANCER SCREENING

Identification of early skin cancer remains important to minimizing patient morbidity and mortality. Nurses are assuming an increasingly important role in the diagnosis of skin cancer. In addition to providing education for primary and secondary skin cancer prevention, nurses can perform screening total body skin examinations as well as the triage of symptomatic and concerning skin lesions. In order to provide the best patient care, nurses should be familiar with diagnostic aids for skin cancer. During the clinical examination, the “ugly duckling” sign can complement the use of the ABCDE mnemonic. In centers that use total body photography to monitor patients at high risk for melanoma, nurses can perform the initial total body photography examination using a comparative diagnostic approach.

Dermoscopic monitoring of lesions and sequential digital dermoscopy imaging contributes to comparative recognition of new or evolved atypical lesions. Together with patient history, utilization of clinical evaluation criteria for melanoma, *i.e.*, the ABCDE mnemonic and ugly duckling sign, and digital photography comparison, dermoscopy aids clinicians in arriving at a confident decision for biopsying suspicious lesions.^[17] In addition, the TADA algorithm is a simple skin lesion triaging pathway that can be used by nurses to improve their assessment of skin lesions.

The ability to accurately detect skin cancer requires awareness of the ABCDE mnemonic, the importance of detecting

outlier lesions, and the use of dermoscopy. Nurses can principally contribute to the early detection of skin cancer by appropriately triaging lesions. It is vital to gather pertinent patient skin cancer history including previous history of skin cancer, including anatomic sites, treatment modality, and dates. Questioning also includes patient risk factors for skin cancer, UVR exposure history, compliance with skin self-examinations, medications, and date of last skin examination with a health care provider.

Nurses should be familiar with the use of dermoscopy in order to maximize their diagnostic sensitivity and specificity for skin cancer, particularly melanoma. Nursing training and education targeted on skin cancer screening assessments and use of tools is key to improving skillset required to ac-

curately assess patients.^[6] The multi-prong approach for the diagnosis of melanoma may be particularly suitable for nurses, as it is easy to learn and comprehensive. The multi-prong approach can help nurses during skin lesion triage; the mnemonic DERM (see Figure 13) may be useful to remember its components.

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CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

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