# Early detection of melanoma: Reviewing the ABCDEs

American Academy of Dermatology Ad Hoc Task Force for the ABCDEs of Melanoma:
Hensin Tsao, MD, PhD, (Chair),[a] Jeannette M. Olazagasti, BS,[b,c] Kelly M. Cordoro, MD,[d] Jerry D. Brewer, MD,[b,c] Susan C. Taylor, MD,[e] Jeremy S. Bordeaux, MD, MPH,[f] Mary-Margaret Chren, MD,[d,g] Arthur J. Sober, MD,[a] Connie Tegeler,[h] Reva Bhushan, PhD,[h] and Wendy Smith Begolka, MBS[h]
*Boston, Massachusetts; Rochester, Minnesota; San Juan, Puerto Rico; San Francisco, California; Philadelphia, Pennsylvania; Cleveland, Ohio; and Schaumburg, Illinois*

Over the course of their nearly 30-year history, the ABCD(E) criteria have been used globally in medical education and in the lay press to provide simple parameters for assessment of pigmented lesions that need to be further evaluated by a dermatologist. In this article, the efficacy and limitations of the ABCDE criteria as both a clinical tool and a public message will be reviewed. (J Am Acad Dermatol 2015;72:717-23.)

***Key words:*** ABCDE; criteria; detection; diagnosis; melanoma; screening.

The ABCD(E) mnemonic of melanoma has been a cornerstone of public health messaging for the community and physicians to help detect early melanomas. Thickness of a primary melanoma is the best prognostic factor in predicting clinical course; therefore, early diagnosis followed by curative surgery is crucial in melanoma management.[1] Pre-1980s, diagnosis of melanoma was often made by gross macroscopic features such as ulceration and bleeding.[2] As these features were predominantly found in advanced lesions, they were of limited use in the recognition of early melanomas, and studies during that time were beginning to demonstrate that other clinical characteristics, such as change in color and size, related to earlier melanomas.[3]

In an effort to educate primary health care physicians and the public on the detection of melanoma in early clinical stages, Friedman et al[4] published the ABCD mnemonic (asymmetry, border irregularity, color variegation, diameter >6 mm) in 1985. In 2004, the letter E (for evolution) was added to the criteria in recognition that rapidly changing/appearing moles may signify melanoma (Fig 1).[5] The mnemonic's intention was to be a simple, straightforward tool; therefore it does not provide a comprehensive template of all melanoma characteristics. Clinical lesions do not need to have all ABCDE features to suggest that they may represent melanoma. Rather, the index of suspicion is additive and aided by the ABCDE features; the more criteria the lesion displays, the greater suspicion for melanoma.

## EFFICACY OF THE ABCDE CRITERIA

The diagnostic usefulness of the ABCDEs by dermatologists, other health care providers, and laypersons has been evaluated in multiple

From the Department of Dermatology, Massachusetts General Hospital and Harvard Medical School[a]; Department of Dermatology, Mayo Clinic, Rochester[b]; School of Medicine, University of Puerto Rico[c]; Department of Dermatology, University of California, San Francisco[d]; Society Hill Dermatology and Cosmetic Center, Philadelphia[e]; Department of Dermatology, University Hospitals Case Medical Center, and Case Western Reserve University School of Medicine, Cleveland[f]; Dermatology Service, San Francisco Veterans Affairs Medical Center[g]; and American Academy of Dermatology, Schaumburg.[h]

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Reprint requests: Wendy Smith Begolka, MBS, American Academy of Dermatology, 930 East Woodfield Rd, Schaumburg, IL 60173. E-mail: wsmithbegolka@aad.org.

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studies.[6-12] Sensitivity and specificity of the criteria vary according to whether they are used individually or in conjunction with one another. In addition, the level of experience of the practitioner using the ABCDE criteria also influences accuracy. When used by dermatologists for the diagnosis of melanoma, the individual ABCDE criteria have sensitivities of 57%, 57%, 65%, 90%, and 84%, and specificities of 72%, 71%, 59%, 63%, and 90%, respectively.[6] However, when used in conjunction with one another, the sensitivity and specificity are 89.3% and 65.3% for 2 criteria, and 65.5% and 81% for 3 criteria.[6] Interrater reliability also demonstrates that the criteria of asymmetry, irregular borders, and haphazard color can be recognized with a significant degree of reproducibility by physicians specialized in cancer detection.[7] The high sensitivity and the interobserver concordance in the use of the ABCDEs support their use as a screening tool in this expert setting, and the repeated demonstration of the accuracy of detection of early melanoma by dermatologists.[13,14]

**CAPSULE SUMMARY**

- The ABCDE mnemonic is a cornerstone messaging tool for the community and physicians to detect melanomas.
- The ABCDEs will not apply to all melanomas, yet the individual criteria have validity and usefulness to identify suspicious lesions.
- Further research is needed to determine the ongoing value and importance of the ABCDEs to physicians and the public.

Frequently however, the initial presentation of skin cancer is to primary care providers. As melanomas diagnosed in this setting are often thicker, or at a later stage of disease,[15-18] education of general physicians is integral to the early detection of skin cancer.[19-21] Although there are limited studies assessing the diagnostic and referral accuracy of general practitioners using the ABCDE criteria, available data suggest the value of training efforts in melanoma screening.[22] Carli et al[8] evaluated the impact of a short, formal ABCDE training session on melanoma screening in family medicine, finding an increased diagnostic accuracy of dermatologic referral from 46.8% at baseline to 76.2% posttraining without significant loss of referral sensitivity (96.1% baseline; 94.8% posttraining). Similarly, the criteria proved a valuable diagnostic tool in a study evaluating the impact of a campaign training general practitioners in the ABCDEs.[9] Posttraining, 36% of 210 physicians detected melanoma over a median period of 27 months and 15% submitted corresponding pathological reports on 37 confirmed melanomas. Most lesions were detected at an early stage (low Breslow thickness), suggesting the training promoted effective screening of melanoma. Likewise, an Internet-based interactive educational program for physicians emphasizing the ABCD criteria demonstrated improvements in diagnostic sensitivity (72% baseline; 92% posttraining).[23]

In 40% to 47% of cases, however, melanoma is self-detected by patients.[10,11] Since the 1980s there has been a large effort to educate the public on the detection of early skin cancer, and these efforts by several organizations have included the ABCD(E) criteria. Several studies have evaluated factors associated with self-detection of melanoma and laypersons' ability to detect melanoma using the ABCDEs. In a study addressing the variables associated with self-detected melanomas, knowledge of the ABCD rule and the habit of performing skin self-examinations were present, suggesting educational information such as the ABCDE criteria can help laypersons self-detect suspicious lesions.[10] Bränström et al[12] evaluated laypersons' ability to discriminate between benign and malignant pigmented lesions and found that, although knowledge of ABCD criteria enhanced participants' ability to make adequate action assessments, the danger of benign pigmented lesions was often overestimated. Other studies have focused on which of the ABCDEs patients notice more when distinguishing melanoma from benign lesions, with results suggesting that "E" features (including change in color, size, elevation), or other symptoms such as bleeding or itching, are the concern that most often prompts medical attention.[3,24-31]

The layperson's ability to distinguish between benign and malignant pigmented lesions can be enhanced through ABCDE educational efforts, but results are mixed regarding clinical effect. A recent systematic review of visual images for patient skin self-examination and melanoma detection found that untrained novices have difficulty with application of the ABCDE criteria without the use of images.[32] Adding text to the ABCDE photographs lowered the benefit compared with the photographs alone. Furthermore, laypersons were not able to use solely text-based descriptions of the ABCDE criteria to reliably distinguish images of malignant from benign lesions. The usefulness of education on the ABCDE criteria to influence skin self-examination accuracy and melanoma detection is unclear as influence on detection was mixed,[32] but enhancing layperson visual memory of their own pigmented

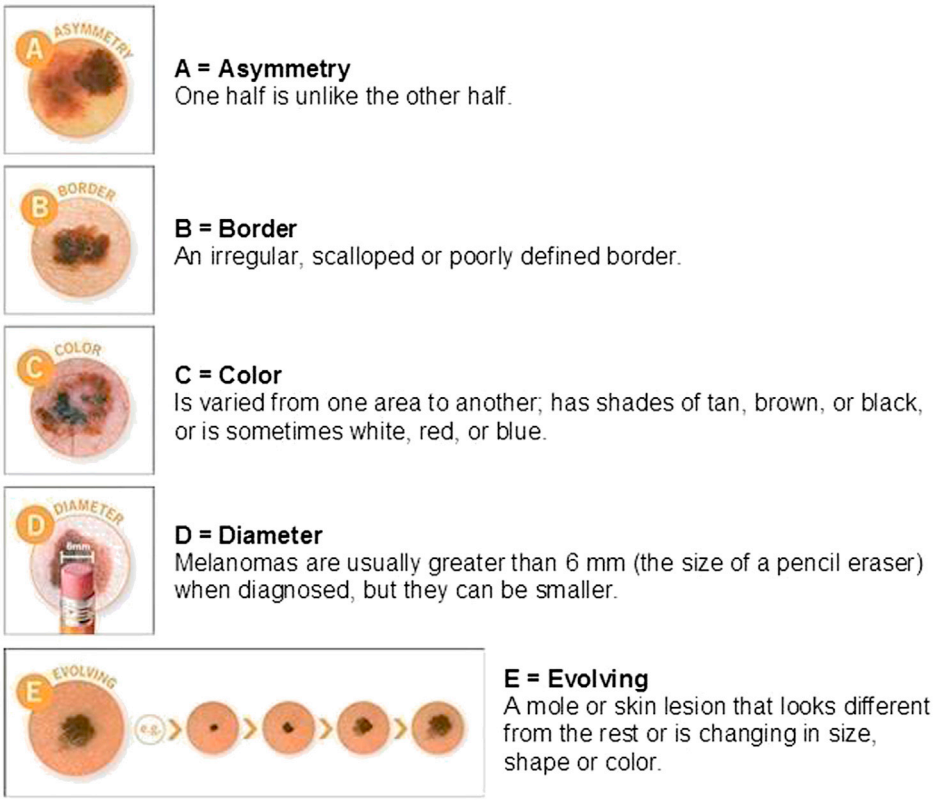


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**Fig 1.** ABCDE criteria for skin cancer detection.

lesions through the use of baseline photography, coupled with images of the ABCDEs, may prove useful over time to detect suspicious lesions.

## USE OF THE DIAMETER (D) CRITERION

An important challenge to the ABCDE criteria is in recognition of small melanomas less than 6 mm. In 2008, Abbasi et al[33] examined whether the diameter criterion should be revised to include melanomas less than 6 mm. They elucidated the relationship between lesion diameter and melanoma diagnosis among 1657 consecutive atypical pigmented skin lesions biopsied by dermatologists. Of these, 51.5% were less than 6 mm in diameter and 48.5% were more than 6 mm. Invasive/in situ melanomas were diagnosed in 4.2% of lesions less than 6 mm, and 12.8% of lesions more than 6 mm. In 1 mm diameter cut-points (ie, 2-3, 3-4, 4-5, and 5-6 mm) all sizes had roughly a 4% rate of confirmed melanoma. This rate doubled to approximately 8% with a diameter of 6 to 7 mm, and continued to increase with increases in diameter. Receiver operating characteristic analysis demonstrated the usefulness of the 6 mm threshold, with downward revision of the criterion to 5 mm (or lower) resulting in significant loss of specificity.[33]

Several prospective studies have assessed the frequency of small melanomas. One study found that small melanomas (<6 mm) comprised 2.2% of all lesions biopsied[33]; however, others have reported larger estimates ranging from 11.4% (≤7 mm) to 22% (<5 mm).[27,34] However, small diameter may not be indicative of early melanoma, as diameter may not always correlate with level of invasiveness. Seidenari et al[35] recently showed that generally, as melanoma diameter increased, Breslow depth also increased; however, about 30% of lesions less than 6 mm were invasive. Another study demonstrated a trend toward smaller diameter melanomas over a 10-year period, yet thickness remained substantially unchanged over time.[36]

Studies have also demonstrated that the diagnostic usefulness of ABC parameters may be different in lesions of different diameters. Analysis of clinical and dermoscopic features of small pigmented melanocytic lesions found clinical asymmetry detectable in 32.4% of melanomas less than 6 mm, border irregularity in 47.1%, and color

variegation in 64.7%.[37] Similarly, another study reported that referring physicians suspected melanoma in only 50% of lesions less than 6 mm as a result of presence of asymmetry, irregular shape, and/or color variegation.[38] The ability of laypersons to detect ABC or E changes in small melanomas has not been assessed, but is anticipated to also result in reduced usefulness to identify suspicious lesions.

Dark color is another feature detected in many melanomas; therefore, some studies have suggested that the "D" in ABCDE be used for "dark" rather than "diameter." Most evidence supporting dark as a clinical criterion comes from indirect observational studies assessing the clinical features of melanoma (superficial spreading melanoma [SSM] and nodular melanoma), particularly those involving small melanomas. This evidence is both from clinician documentation and patient-reported concerns that led to medical evaluation. In a case series by Kamino et al,[38] 20% (4/20) of small melanomas (<6 mm) were darkly pigmented, however, Bergman et al[39] found this percentage to be significantly lower (3.5%; 4/112). The intensity of dark pigment has been noted as a clinical characteristic in small melanomas less than 4 mm,[40] and Helsing and Loeb[27] indicated that darker color change was a more frequent observation among small melanomas (<7 mm), compared with non-small melanomas. Patient perceptions of presenting features for 92 SSM and 33 nodular melanomas indicated that the predominant color of SSM was dark brown (37.8%) followed by black (26.7%) and light brown (17.8%), and the predominant color of nodular melanoma was pink (33.3%) followed by black (24.3%) and red (21.2%).[26] Similarly, Warycha et al[29] reported on the presentation of 812 SSM and 126 nodular melanomas noting the predominant color of SSM was brown (47.3%) followed by black (31.3%) and light brown (17.6%) whereas the predominant color of the nodular melanoma was black (42.9%) followed by brown (26.2%). Although these observations are noteworthy, to date, no studies have specifically focused on an assessment of dark as a parameter alone, in comparison with diameter, or in combination with the other ABC and E criteria, for early melanoma detection. Although it is apparent that a significant percentage of melanomas may be less than 6 mm and therefore may not be detected solely through use of the diameter criterion, the weight of current evidence continues to support the usefulness of diameter, particularly when used in conjunction with the other ABCDE criteria.

## ABCDEs IN OTHER SITUATIONS

There are other instances where the criteria are also less effective in the early diagnosis of melanoma, for example, in the case of nodular melanoma.[41] In a retrospective study, Chamberlain et al[26] identified clinical features that could facilitate earlier detection, finding that nodular melanoma are often symmetric, elevated, uniform in color, and nonpigmented, and may not exhibit any of the ABCD criteria. Furthermore, nodular melanoma rarely changes color.[26] The addition of the "E" (for "evolving") criterion to the ABCDs in 2004 was an effort to incorporate the often rapid changes of nodular melanoma (size, shape, height, and other symptoms) into the mnemonic,[5] although others proposed that "E" could alternatively signify "elevation."[42] Identifying additional early presenting features of nodular melanoma are necessary to reduce mortality from this subtype of melanoma. Although nodular melanoma is not as common as the SSM subtype, it is considered the second most common form of melanoma and should be further studied in light of the ABCDE criteria. Similarly, other more rare forms of melanoma such as amelanotic melanoma and desmoplastic melanoma also often lack the ABCDEs.[43,44]

Building on the premise of the ABCDEs, alternate mnemonics have been proposed for subtypes of melanoma. Levit et al[45] proposed the ABCDEF criteria for subungual melanoma (age, African Americans, Asians, Native Americans; brown to black band; change in the nail band; digit most commonly involved; extension of the pigment onto the proximal and/or lateral nailfold; and family or personal history of melanoma). Likewise, pediatric melanoma does not always follow the conventional ABCDE criteria.[46-51] Cordoro et al[52] recently performed a retrospective study of pediatric melanoma in 2 age groups, 0 to 10 years (group A) and 11 to 19 years (group B). In all, 60% of group A and 40% of group B did not present with conventional ABCDE criteria, but rather with amelanosis, bleeding, "bumps," uniform color, variable diameter, and de novo development. Therefore, they suggested additional ABCD criteria (amelanotic; bleeding, bump; color uniformity; de novo, any diameter) used along with the traditional ABCDE criteria may facilitate earlier recognition of melanoma in children.[52]

Although it is clear that the original ABCDEs are not applicable to all presentations of melanoma, and many melanomas will still be missed by relying solely on the original mnemonic, the impact of these newer and highly specific criteria on the early

detection of melanoma for physicians or the layperson remains unknown.

## OTHER EARLY DETECTION TOOLS

Other paradigms for early melanoma detection have been developed throughout the years. The Glasgow 7-point checklist, developed in 1985 has been advocated as a sensitive screening test for melanoma.[53,54] It consists of 7 features (sensory change, diameter >1 cm, lesion growth, irregular edge, irregular pigmentation, inflammation, and crusting, oozing, or bleeding) that are observed more commonly in melanomas than other pigmented lesions.[53] Melanomas were more likely to have at least 3 of the 7 features. In 1989, the group revised the list to consist of 3 major features (change in size, shape or color) and 4 minor features (inflammation, crusting or bleeding, sensory change, and diameter >7 mm).[54] Healsmith et al[54] assessed the sensitivity and specificity of the 7-point checklist for early diagnosis of melanoma compared with the ABCDE criteria, finding the ABCDEs to be less sensitive. However in another study, the ABCDE had similar specificity (0.88 vs 0.94) and better sensitivity (0.73 vs 0.44) compared with the 7-point checklist.[55]

As a public message the current ABCDEs may be rather difficult to understand and remember. Therefore, attempts at simpler tools have been undertaken. For example, Luttrell et al[56] suggested the AC rule for melanoma (asymmetry, color variation) that, similar to the ABCDE criteria, can be used for both clinical and dermoscopic assessment. A study assessing the sensitivity and specificity of laypersons to detect melanoma using the AC rule found high sensitivity (91.2%) for melanoma detection when viewing photographs.[56] Similarly, a recent report suggested a "Do UC the Melanoma?" approach to emphasize the different, uneven, and changing characteristics of melanoma.[57]

Another simple tool is the "ugly duckling" sign. Introduced by Grob and Bonerandi[58] in 1998, it is based on the premise that an individual's nevi share common characteristics (ie, a "signature nevus"[59]), and that melanoma often deviates from this nevus pattern. Although the ugly duckling sign may also be useful in melanoma screening, there are currently no studies comparing its performance alone, or in concert with other methods including the ABCDE criteria.[58]

## Conclusion

Although the diagnostic accuracy of the ABCDEs has been verified in clinical practice, and are a useful tool when used by dermatologists, to our knowledge, no randomized clinical trial has been performed to demonstrate that using the ABCDE criteria improves the ability to perform early detection by the public. Further research will be important to determine if the ABCDE criteria should be altered or set aside in favor of a newer paradigm. Many questions remain unanswered including dermatologists' and primary care physicians' use of the ABCDE criteria to educate their patients, their usefulness as a public health message and self-detection tool for laypersons, and if early detection can be enhanced by using the ABCDEs in parallel with other tools and approaches. What is clear, however, is like any tool, the ABCDEs have strengths and limitations, but for now, they remain a valuable component of the early detection campaign against this deadly skin cancer.

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