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Commentary

Beyond the surface: a color-inclusive guide to central line site assessment

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Abstract

Significant gaps exist in representation of diverse populations in central-line assessment education and tools. We review some of these gaps and provide some real-world guidance on how to assess central line sites in patients of all skin tones.

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Patients who develop a central line-associated bloodstream infection (CLABSI) or hospital-onset bacteremia (HOB) incur higher medical costs, longer lengths of stay, and increased mortality.[1,2] While more studies are needed, existing evidence suggests there are inequities in CLABSI and HOB, with higher rates in patients of color compared to White patients.[3] Notably, these inequities persist even after adjustment for patient-specific comorbidities and risk factors.[4,5] McGrath et al. showed improvement in CLABSI rates in Black patients after implementing quality improvement interventions that included a focus on increasing the proportion of central line (CL) maintenance audits in patients of color. Few other studies have evaluated how to mitigate identified inequities.[6]

Over the last few decades, hospitals have made great improvements in preventing CLABSI.[7] Standardizing techniques in insertion and maintenance of central lines have been key contributors to longitudinal improvement.[8,9] Providing initial and ongoing education on CL maintenance to staff who care for these devices has long been recommended by the Centers for Disease Control and Prevention and remains in the 2022 CLABSI prevention recommendations.[10,11] While the importance of staff education and competency in assessing and maintaining the CL site has been emphasized, current resources commonly focus on findings of infection or skin inflammation in patients with lightly pigmented skin. In parallel with the insufficient inclusion of patients with diverse skin tones in images across dermatology and nursing literature,[12–15] infection prevention education frequently neglects to include varying ways infected or inflamed skin can present in patients with darkly pigmented skin.

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To assess the current state of tools available for evaluation of CL sites in patients of all skin colors, we convened a multidisciplinary team including infection preventionists, a dermatology physician, infectious disease physicians, and nursing representatives. A literature search was performed to identify evidence-based resources that address the assessment of central lines in patients of all skin colors. While general dermatology publications on the recognition of cutaneous infection and inflammation in patients with darkly pigmented skin were identified, literature on CL assessment that specifically addressed issues particular to patients with darkly pigmented skin was lacking. Similarly, pictures and models used in publicly available educational tools predominantly included patients with White or lightly pigmented skin.[16–26] Outreach to representatives from professional groups such as the Association for Professionals in Infection Control and Epidemiology and central line dressing vendors did not yield any additional relevant tools or resources.

Given the paucity of premade resources, representatives from nursing and infection prevention intentionally focused on assessing patients with a variety of skin tones during CL maintenance audits to improve assessment techniques. Through literature review, collaborative discussion, information accumulated through expert engagement, and CL site image review, tips for assessing CLs in patients of color were developed (Figure 1).

Tips for central line assessment for all skin tones

A commonly acknowledged early indication of infection at the site of CL insertion is the presence of erythema.[17] While erythema may be readily apparent in patients with lightly pigmented skin, recognition of signs of infection may be more challenging in patients with darkly pigmented skin.[27] Physician inter-rater reliability on skin assessment is poor for patients with higher levels of skin pigmentation.[28] Skin changes at sites of infection result from heightened inflammation and increased blood flow in the area.[29] In individuals with darkly

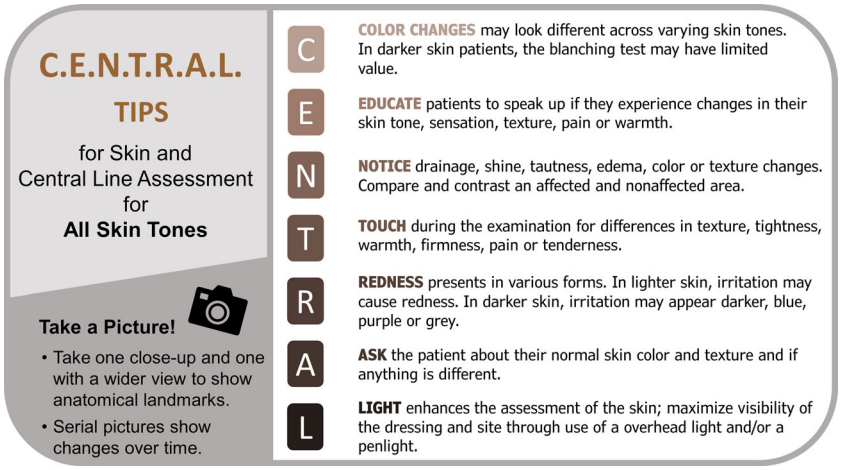

Figure 1. Tips for assessing central lines in varying skin tones.

pigmented skin, inflammation can alter the skin to appear more purple, brown, black, or gray.[27,30] This color change produces less contrast between the affected and unaffected skin, making detection of early signs of infection challenging. This can lead to missed or delayed diagnosis. Assessment beyond visual inspection is critical to recognize inflammation and prevent CLABSI. Healthcare professionals must be aware of other cardinal signs of inflammation such as warmth, swelling, and pain, in addition to the variety of ways infection can present in all skin tones.[31]

1. Visual examination:
   - o Examine and compare: Increased shine, tautness of the skin, and color change (redness, bluish-purple discoloration, gray tone, or hyperpigmentation) can be signs of inflammation and infection. Comparison of the skin around the line to nonimpacted skin can help identify subtle differences.
   - o Lighting matters: Ensure the room lights are on and where possible use an additional source of light to optimally see the site you are evaluating. Fluorescent lights may give skin a blue tint, so using bright light or a penlight is ideal to see the true skin color most accurately.
   - o Pictures: Serial pictures of line sites over time can be helpful in detecting changes. Take one picture close-up to capture details and one picture with a wider view to include anatomic landmarks.

2. Palpation:
   - o Assess changes in texture, firmness, swelling, warmth, induration, and tenderness through physical touch and compare them to characteristics of unaffected skin.
   - o Be aware that the traditional "blanch test" may not be positive in individuals with darkly pigmented skin.[32] This test assesses blood flow by applying pressure and evaluating if the area turns white or pale for longer than normal.

3. Gathering patient input:
   - o Whenever possible, ask what is normal for the patient and if they have noticed any skin changes, pain, or tenderness at the line site.
   - o Be cognizant of cultural or social customs that can cause changes to skin.
   - o Ensure patient communication is culturally appropriate and consider any educational or language barriers that may impact comprehension.

Next steps and a call to action

The development and implementation of education is one step on the journey of bringing to light unintentional differences in patient care and, subsequently, achieving equity in care. Patient feedback and engagement on educational content and further opportunities to improve care for all patients, while often overlooked, is a key next step in this work. In addition, skin color is only one dimension of the patient that may impact differential quality in central line assessment. Other factors such as obesity and language, educational or cultural barriers between patients, and healthcare workers necessitate future exploration.

As with any educational effort in healthcare, adult learning principles and the variety of learning styles must be considered when developing educational methods to address the knowledge, skill, or practice gap. While distribution and communication of content in printed materials is important, it may not be effective for sustained change. Diverse skin assessment content, such as images of CL sites in skin of color, should be incorporated into orientation, annual regulatory competencies, and, perhaps most importantly, microlearning environments such as bedside rounding. Interactive case-based scenarios in which healthcare professionals are guided through the accurate evaluation of CL in patients with a variety of skin pigmentations may be particularly effective in improving clinical skills.

Where possible, sharing data stratified by sociodemographic factors for CLABSI outcomes and CL maintenance-related process measures can improve awareness and reinforce inclusive educational efforts. Standardized CL assessments with a focus on patients of various skin tones and feedback to staff with real-world pictures can help solidify concepts. Finally, many of the CL educational tools that are publicly available do not reflect a diverse patient population, and literature within healthcare epidemiology on healthcare disparities is limited. Moving consciously towards inclusion in all aspects of infection prevention and antibiotic stewardship is necessary to make sure we are providing equitable healthcare to all.

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