Risk assessment for pressure injuries

ABSTRACT

This manuscript highlights commonly used pressure injury (PI) risk assessment instruments (scales) and other considerations that the clinician should contemplate for use in everyday practice to determine if their patient is at risk for a PI.

Keywords pressure injury, risk factors, risk assessment scales

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INTRODUCTION

Each year in November, many professional organisations participate in the Stop Pressure Injuries/Ulcers Day. It provides an opportunity to raise awareness about pressure injuries (PIs) to the general public as well as other healthcare professionals. Preventing PIs is an important part of a clinician's everyday practice. The intent of this article is to provide a succinct summary of some of the commonly used PI risk assessment instruments (scales) as well as other patient characteristics to consider as part of a comprehensive risk assessment process.

RISK ASSESSMENT OVERVIEW

The purpose of risk assessment is to identify if a person is at risk for a PI and, if so, implement an individualised prevention plan especially considering modifiable and non-modifiable risk factors[1]. The 2019 International Guideline with implementation recommendations[1] provides assistance for clinicians for best practices for individuals at risk for a PI regardless of the care setting. Risk assessment is one of the key components to consider when preventing PIs. It is a systematic process that at minimum includes examination of the person's skin for any changes, awareness of any devices, including medical and other objects that can cause pressure, assessment of individual patient characteristics that are known to be risk factors, and assessment using a validated/reliable risk assessment instrument (scale) and the clinician's clinical judgement.

RISK ASSESSMENT INSTRUMENTS

There are several valid and reliable risk assessment instruments (scales) available (Table 1), so it is important to use the one that reflects the age of your population and your practice setting. Some of the risk assessment instruments have a manual of instructions or glossary of terms for their use. The clinician should understand the definition of the terms used in the instrument so that they know how to accurately assess their patient for each of the risk factors outlined in the chosen instrument.

Most practice settings have a specific policy or guidance as to when risk assessments should be performed. The first general practice for performing a risk assessment is upon the person's admission to a facility, e.g., hospital, long-term care/nursing home, rehabilitation, outpatient setting (e.g., clinics) or homecare assignment. Subsequent risk assessments are based on the clinical setting. For example, in acute care facilities, clinicians perform a risk assessment daily upon transfer to another nursing unit, when the patient's condition changes, and upon discharge from the facility. In nursing homes or long-term care facilities, clinicians tend to perform risk assessments weekly and upon discharge. In homecare organisations, clinicians tend to perform a risk assessment on every visit, much like outpatient settings. It goes without saying that the clinician should follow the policy of their work setting and accurately evaluate the person according to each risk factor on

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the instrument. It is important to note that a clinician should also employ their judgment to a person's PI risk outside of using a risk assessment instrument.

The following section provides a short description of the more commonly used risk assessment instruments.

Adult risk assessment instruments

Norton Pressure Sore Risk-Assessment Scale

Widely acknowledged as the first known scale is the Norton Pressure Sore Risk-Assessment Scale[2]. It was created in England in 1962 by Doreen Norton. It has five categories (Table 1) to which a number score is assigned based on the descriptor terms. When the numbers are totalled, low risk is determined to be >18, medium risk from 14–18, and lower numbers indicate higher risk, with <10 considered very high risk[3].

Waterlow Pressure Ulcer Prevention/Treatment Score

The Waterlow Score was created by Judy Waterlow of the UK in 1985 and was revised in 2005 by Queensland Health[4]. As seen in Table 1, it has six categories. Additionally, the Malnutrition Screening Tool (MST) is used to assess the person's nutritional status on this scale. There is also a section entitled 'Special risks'. The scores are added, with a person being considered at risk when the score is >10, high risk at >15 and very high risk at >20. The back of the scale card has a short summary of prevention strategies as well as the European Pressure Ulcer Advisory Panel (EPUAP) classification definitions; further details can be found at the judy-waterlow.co.uk website[5].

Braden Scale for Predicting Pressure Sore Risk

Known by many as the Braden Scale, it was created in the USA by Drs Barbara Braden and Nancy Bergstrom based on a conceptual schema which they published in 1987[6–8]. The Scale has six assessment risk factors – sensory/perception, moisture, activity, mobility, nutrition and friction/shear (Table 1). Several early publications on the validation of the scale were subsequently published[8–11]. Over the years it has been used around the world and has had much research to validate its use in a variety of skin tones[12]. Its intended use is for ages 8–100+ years old. A score of 15–18 is considered to be mild risk, 13–14 moderate risk, 10–12 high risk and <9 severe risk.

Braden Scale II©

The Braden Scale for Predicting Pressure Sore Risk was originally published in the late 1980s[6–8]. Since April 2021, the Braden Scale copyright is now owned by Health Sense Ai and termed the Braden II©[13]. It has been updated in collaboration with original scale developers, Drs Barbara Braden and Nancy Bergstrom, to the Braden Scale II©. You can apply for copyright permission to use the Braden Scale II© by going to their website (www.bradenscale.com[13]), completing the licence use forms and paying the fee.

The Braden Scale II© has the same six risk assessment factors as the original Braden Scale – sensory/perception, moisture, activity, mobility, nutrition and friction/shear. Updates to the Braden Scale II© include language to bring the Scale into compliance with currently used taxonomy, like changing pressure sore to pressure injury. In addition, there are updates to the subsection descriptions to facilitate accurate scoring of the instrument among users. There are no changes to the cut scores at which a patient is considered to be at risk, but plan to address in the patient's plan of care any subscales with higher scores even if the total overall scale score does not indicate the patient is at risk. The Braden Scale II© is available in English, French and Spanish.

To help clinicians score the scale, a glossary of terms has been created and available to use when you obtain copyright use permission. Health Sense AI/HD Nursing also has available several resource materials to help educate clinicians about the Braden Scale II©, including case examples that illustrate how to correctly use the scale[13]. The Braden Scale II© glossary and training module now make up the Braden Scale II Toolkit© which comes as a package when you licence the Braden Scale II©. This helps ensure staff are trained correctly to use the scale in direct patient care.

Paediatric risk assessment instruments

Braden Q Scale

The Braden Q risk assessment instrument was adapted from the Braden Scale by Curley and colleagues[14] and since then has been frequently tested for its reliability and validity[15]. Its intended use in practice is for paediatric patients aged from 21 days (including corrected to gestational age of 21 days) up to age 8. The instrument includes the same six subscales of the Braden Scale with the addition of a seventh item – tissue perfusion and oxygenation. A score of 25 is considered low risk, 21 is medium risk and 16 or below is considered at risk for a PI (Table 1).

Braden QD Scale

The Braden QD is one of the newer risk assessment instruments created by Curley and colleagues[16] and is based on the Braden Q Scale. Its intended use is for paediatric patients from pre-term ages to 21 years old. It contains five items from the Braden Q (mobility, sensory perception, friction/shear, nutrition, tissue perfusion and oxygenation) plus the addition of number of medical devices and repositionability/skin protection, the latter item specifically addressing medical devices (Table 1). A score of ≥13 is considered at risk for a PI[17].

Glamorgan Paediatric Pressure Ulcer Risk Assessment Scale

This scale was created in the late 2000s as the Glamorgan Paediatric Pressure Ulcer Risk Assessment Scale (Glamorgan Scale) and noted to be the first paediatric risk assessment scale to include devices as one of the risk assessment factors[18]. Other Scale points address mobility, the child's condition, anaemia, nutrition, perfusion, weight, incontinence inappropriate for the age, body temperature, albumin and haemoglobin levels, and devices. Any score of 10–14 is considered to be at risk, 15–19 is at high risk, and a score of ≥20 is considered very high risk for a PI.

Table 1. Commonly used PI risk assessment instruments (scales) [©Delmore & Ayello 2022]

Tool / Scale	Population	No. risk factors	Factors to assess	Score
Norton Pressure Sore Risk-Assessment Scale	Adults	5	• Physical condition • Mental condition • Activity • Mobility • Incontinence	>18 = low risk 14–18 = medium risk 14–10 = high risk <10 = very high risk
Waterlow Pressure Ulcer Prevention/ Treatment Score	Adults	9	• Build/weight for height • Skin type visual risk areas • Sex and age • Continence • Mobility • Malnutrition screening tool (MST) • Special risks (3): – tissue malnutrition – neurological deficit – major surgery or trauma	>10 = at risk >15 = high risk >20 = very high risk
Braden Scale for Predicting Pressure Sore Risk **Braden Scale II©**	Adults, children beginning 8 years old	6	• Sensory/perception • Moisture • Activity • Mobility • Nutrition • Friction/shear	15–18 = mild risk 13–14 = moderate risk 10–12 = high risk <9= severe risk
Braden Q Scale	21 days old up to 8 years old	7	• Sensory/perception • Moisture • Activity • Mobility • Nutrition • Friction/shear • Tissue perfusion and oxygenation	25 = low risk 21 = medium risk ≤16 = at risk for PI
Braden QD Scale	Birth to 21 years old	7	• Mobility • Sensory/perception • Friction/shear • Nutrition • Tissue perfusion and oxygenation • Number of medical devices • Medical device / repositionability/ skin protection	≥13 = at risk
Glamorgan Paediatric Pressure Ulcer Risk Assessment Scale	Birth to 18 years old	10	• Mobility • Child's condition • Anaemia • Nutrition • Perfusion • Weight • Incontinence inappropriate for age • Body temperature • Albumin and haemoglobin levels • Devices and hard surfaces	10–14 = at risk 15–19 = high risk ≥20= very high risk
Neonatal Skin Risk Assessment Scale	Neonates	6	• General physical condition (gestational age) • Mental state • Mobility • Activity • Nutrition • Moisture	≥13 = at risk

Neonatal Skin Risk Assessment Scale

This scale was created by Huffines and Logsdon in the late 1990s and was based on the Braden Scale[19]. It was the first scale tested for reliability and validity for the neonatal population. The neonate is scored based on general physical condition (gestational age), mental state, mobility, activity, nutrition and moisture. A score of ≥13 is considered to be at risk.

POPULATIONS AT RISK

Older adults

Advanced age (≥65 years) is a PI intrinsic risk factor. Much of the risk is from skin changes that occur due to the ageing process such as epidermal thinning and loss of adipose tissue as a protective function. Additionally, disease burden and presence of co-morbidities create PI risk in this population[20,21]. Assessing risk using a valid and reliable scale is only one component of assessing an older adult's PI risk. In this case, risk factors should be considered that are not included (e.g., age, disease burden) or reflect the degree of a condition's severity (e.g., malnutrition)[20–22].

Patients with obesity

According to the 2019 International Guideline, patients with obesity are considered a population that requires diligent PI risk assessments[23]. Obesity is an under recognised complex condition[22]. The Centers for Disease Control and Prevention (CDC) defines obesity by body mass index (BMI) categories: Class 1, BMI of 30–35kg/m^2; Class 2, BMI of 35–40kg/m^2; and Class 3, BMI of 40kg/m^2 or higher and considered severe[24]. In this population, PIs occur due to a variety of factors such as malnutrition, diseases and conditions associated with obesity and device-related PIs due to ill-fitting equipment[22,23].

Surgical patients

Assessment of the research literature in the 2019 International Guideline supports that the duration of time from when a person is admitted to when they have surgery as well as the length of time they are in surgery may be markers of a patient's immobility[1]. Additionally, a person's American Society of Anesthesiologists (ASA) Physical Status Classification may be a marker of the patient's clinical status[22]. All three of these should be considered as risk factors for a person undergoing surgery.

Critical care

Critically ill patients are another special population that should be considered high risk for PI formation and therefore require diligent PI risk assessments[23]. The reason for this high risk is due to the critical illness of this population, the setting itself, and the abundant presence of medical devices required for treatment[25,26]. It is paramount to monitor this population closely as the addition of a PI to an already complex situation is considered an additional co-morbidity that can possibly lead to mortality[23].

OTHER CONSIDERATIONS FOR RISK

Devices and objects

Medical devices and other objects such as eyeglasses and bottle caps can cause PIs[27–29]. Medical devices are the most frequent aetiology for medical device-related pressure injuries (MDRPI) in neonates and children[1,16–18,30] (Figure 1); therefore, consideration for using the Braden QD Scale[16] and the Glamorgan Scale[18], which both include assessments for medical devices, is warranted.

MDRPI also occur in adults[27] (Figure 2). Currently, none of the adult PI risk assessment scales assess for MDRPI even though

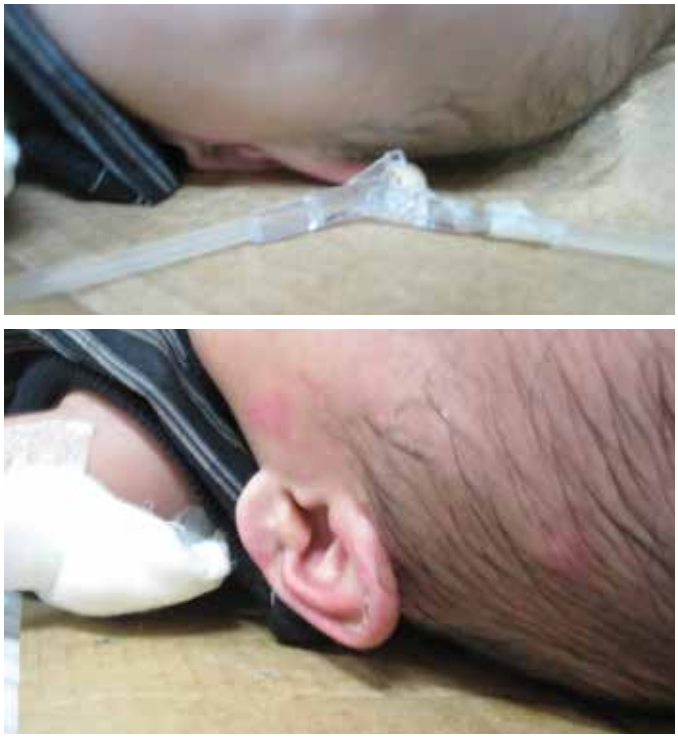

Figure 1. PI that developed from baby lying on IV tubing [©EA Ayello 2015, used with permission]

Figure 2. PI as a result of an intravenous (IV) hub that was secured directly to the skin. Notice the imprint on the skin that matches the design of the IV hub [©Delmore 2015, used with permission]

the 2019 International Guideline does address PI from devices – medical and other sources[27]. Therefore, raising awareness of devices as an aetiology for device-related PIs in adults is of great importance[1,27–29]. Consider using the SORE mnemonic to alert staff to medical and other devices that can cause PIs[28]. Research has supported that MDRPI occur 3 days sooner than other PIs, so staff need to be vigilant in assessing patients who have medical devices[29]. Remember to keep track of your facility's MDRPI incidence[28]. Also, MDRPI on the lip cannot be staged as mucosa, does not keratinise and therefore cannot be staged using the NPIAP staging classification system[1,27,28].

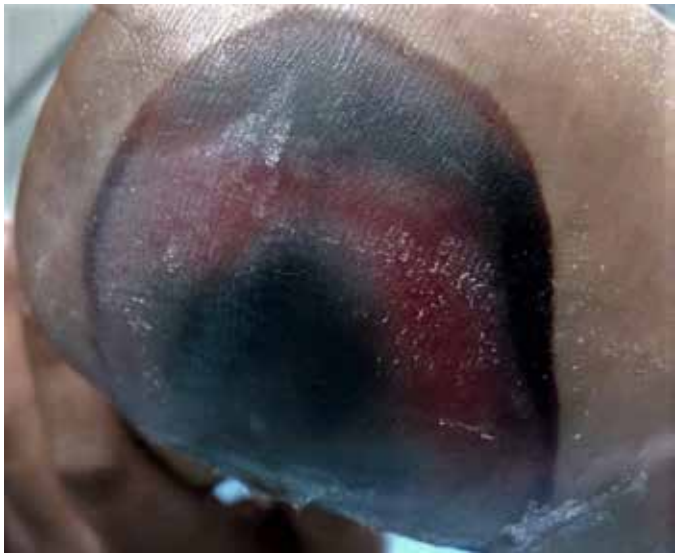

Figure 3. Deep tissue pressure injury (DTPI) of the right heel. Unlike Stage 1 PIs that are intact and a lighter red/pink, DTPIs are intact but have a deeper discolouration indicating a deeper level of damage. These full-thickness PIs often evolve to a Stage 3 or 4, or an unstageable PI [©B Delmore & EA Ayello, 2020, used with permission]

Specific anatomical areas at risk

Heels

Heels are believed to be the second most common anatomical site for PIs[31]. Due to the anatomy of the heel and limited tissue by the calcaneus, the heel is a particularly vulnerable to risk of a PI[31–36] (Figure 3). Two research studies[32,33] have provided evidence that patient co-morbidities, specifically diabetes mellitus and vascular disease along with immobility, are risk factors for developing heel PIs and should be considered with assessing a person's risk for heel PIs along with a validated risk assessment instrument[32–34].

In the main analysis (n=337) in one hospital, the predictor variables for heel PIs were diabetes, vascular disease, immobility and Braden Scale <18[32]. The study was expanded to other hospitals by using data from the New York State Statewide planning and Research Cooperative system (SPARCS)[33]. The main analysis had 1,697 patients (323 patients who had heel PIs and 1,374 who did not). There were seven significant and independent predictors – diabetes, vascular disease, perfusion issues, impaired nutrition, age ≥65 years, mechanical ventilation and surgery. Based in part from these two studies, the authors concluded that patient comorbidities, in this instance both diabetes and vascular disease, should be considered as risk factors along with results of formal risk assessment instruments[33]. Clinicians may find our heels algorithm helpful in their practice[34] (Figure 4).

Foot position may also be a risk factor. In another study of 10 healthy male volunteers, there was more strain on the heel tissue when the foot was in external rotation rather than upright (90°)[36]. Our recent clinical practice point may be helpful to clinicians as to proper foot positioning to help prevent heel PIs[34].

Heel PI enabler based on validated risk factors. The enabler should be used in conjunction with clinical judgement, individual patient assessment, patient needs and care goals

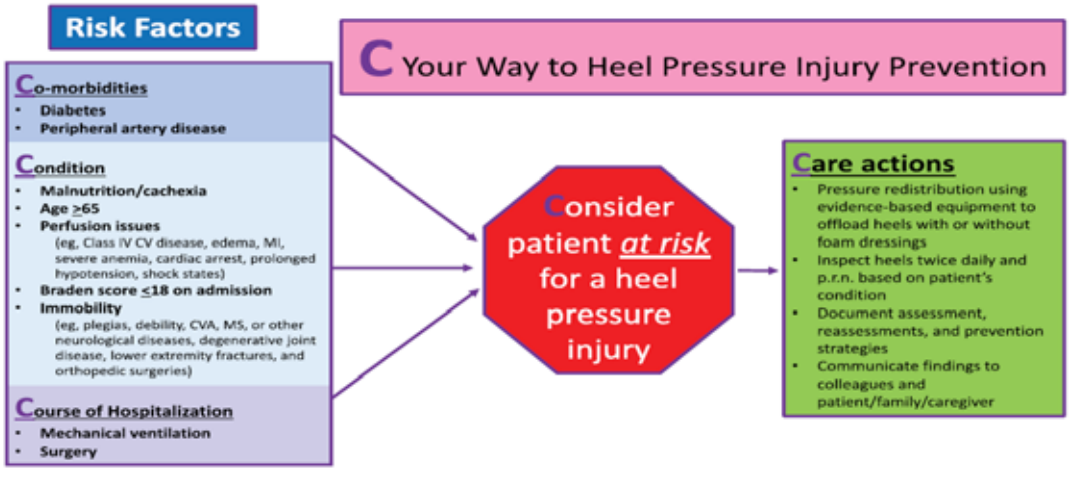

Figure 4. Heel pressure injury algorithm [©Delmore, Ayello & Smart 2020, used with permission][32–34]
CV – cardiovascular; CVA – cerebrovascular accident; MI – myocardial infarction; MS – multiple sclerosis

Sacrum/coccygeal/ischial tuberosities

The sacrum is the most common anatomical site for PIs. Some research suggests that a patient's skeletal morphology may be an intrinsic non-modifiable risk for PI. The work of Gefen[37] provides knowledge about changes in persons with spinal cord injury that increase risk for PI. This includes skeletal muscle atrophy, fat infiltration into muscles, bone shape loss leading to flattening of the tips of the ischial tuberosities and thinning of the skin around the ischial tuberositites[37].

A recent retrospective case-control study by Delmore and colleagues compared the skeletal sacrococcygeal region of 15 patients with full-thickness PIs to 15 patients without full-thickness PIs using MRIs[38]. The premise of this study was to determine if the skeletal sacrococcygeal region may act as a possible intrinsic PI risk factor. Findings revealed that patients with full-thickness PIs did have different morphology and morphometry, resembling patients with other conditions. This study also noted that PIs in this region were more located in the coccyx region.

RISK ASSESSMENT INSTRUMENTS AND TECHNOLOGY

There is some growing debate in the literature about use of risk assessment scales as they may not capture all important risk factors, so do think about patient comorbidities that may not be captured on a risk assessment scale. There is research to study identification of additional risk factors and/or early indicators for PI including skin temperature[39,40] as well as subdermal moisture and imaging[41–43]. It will be interesting to see how various technologies will reduce cost[43]. The future of PI risk assessment may include a systematic risk assessment including a valid and reliability scale, patient characteristics such as comorbidities, and technology that will impact on reducing PI incidence.

CONCLUSION AND SUMMARY

There are several valid and reliable PI risk assessment scales available for use in practice. Although research continues to provide evidence as to which are the best in terms of predictive ability, identification of patient co-morbidities as well as technology may be additional data to help clinicians identify persons at risk for PIs. It is most important to remember that PI assessment is a process with the care goal of implementing a care plan in a timely manner to prevent avoidable PI[44] from occurring.

CONFLICT OF INTEREST

Dr Ayello was a member of the small working group on medical device-related pressure injuries for the 2019 EPUAP/NPIAP/PPPIA *Prevention and treatment of pressure ulcers/injuries*[1]. Dr Delmore is a Board Member of the National Pressure Injury Advisory Panel and is on the Editorial Board for *Advances in Skin and Wound Care*. She was a member of a small working group on heel pressure injuries for the 2019 EPUAP/NPIAP/PPPIA *Prevention and treatment of pressure ulcers/injuries*[1].

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