Pressure Ulcers in Neonates and Children: An NPUAP White Paper

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ABSTRACT

Acutely ill and immobilized neonates and children are at risk for pressure ulcers, but a paucity of evidence-based research exists on which to base guidelines for clinical practice. Most prevention and treatment protocols for pressure ulcers in the pediatric population are extrapolated from adult practice. Clinical practice guidelines for prevention and treatment of pressure ulcers that specifically address the needs of the pediatric population are needed. The purpose of this article is to highlight the research that is currently available and to identify gaps that need to be addressed so that science-based, age-appropriate prevention and treatment pressure ulcer guidelines can be developed.

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There is an emerging awareness that acutely ill and immobilized neonates and children are at risk for pressure ulcers. However, empirical data on which to base guidelines for clinical practice are scarce.[1] In fact, most prevention and treatment protocols are extrapolated from adult practice guidelines.[2,6–10] Given the anatomic and physiologic differences between adults and children, serious concerns arise about the safety, clinical efficacy, and cost-effectiveness of using adult protocols and products for neonates and children.[11,12] Evidence-linked clinical practice guidelines for prevention and treatment that specifically address the pediatric population are needed. The purpose of this article is to highlight the research that is available and to begin to define areas that need to be addressed so that prevention and treatment guidelines can be developed.

PRESSURE ULCER PREVALENCE RATES

Pressure ulcer prevalence rates as high as 27% in pediatric intensive care units (PICUs) and as high as 23% in neonatal intensive care units (NICUs) have been reported. Most pressure ulcers occur within 2 days of admission.[5,8] Among noncritical hospitalized pediatric patients, prevalence rates of 0.47% to 13%, and incidence rates of 0.29% to 6% have been cited.[13–15]

Pallija et al[6] tracked children with spina bifida and spinal cord injuries over 4 years. Of the total 4533 hospital days studied, 22% (n = 994 days) were used to treat pressure ulcers at a cost of over $3 million.[6] The findings of Pallija et al[6] are alarming when one considers that pressure ulcer incidence rates are 20% to 43% among patients with spina bifida.

PRESSURE ULCER RISK FACTORS

Many factors have been identified as contributing to skin breakdown in the pediatric population. However, insufficient evidence exists to determine exactly which are true risk factors and which can be modified or reduced. Suggested risk factors for skin breakdown may be intrinsic, such as duration and amount of pressure, friction, shear, and moisture, or extrinsic, such as perfusion, malnutrition, infection, anemia, and immobility.

The sacrum, the largest bony area, is the most common location for pressure ulcers in adults. In the pediatric population, the occiput is the largest bony prominence and the most common site of pressure ulcer development.[16–18]

Studies identifying skin breakdown in the pediatric population are limited but consistent with the adult population. Baldwin[13] identified sedation, hypotension, sepsis, spinal cord injury, traction devices, and terminal illness as risk factors. Zollo et al[19] studied 14 risk factors for pressure ulcers and only 1, white race, was statistically significant.

Patients with spina bifida and cerebral palsy have an increased risk of pressure ulcers because of their impaired mobility.[19,20] Children undergoing cardiopulmonary bypass surgeries are at increased risk as well.[18] Age, type of congenital heart defect, duration of intubation, and PICU length of stay

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have been identified as risk factors for occipital pressure ulcers.[18] Neidig et al[18] found that age less than 37 months, ventral septal defect repairs, PICU stay of more than 8 days, and intubation for more than 7 days were attributed to a higher risk of pressure ulcers among critically ill children.

High-frequency oscillatory ventilation (HFOV) is confined to the pediatric population. These patients may be exposed to shear and frictional forces from the oscillation as well as some of the other risk factors previously listed. A retrospective cohort study by Schmidt et al[22] revealed that although more patients on HFOV developed pressure ulcers than those on conventional ventilation (53% [n = 32] vs. 12.5% [n = 32]), the length of time in the PICU was statistically significant, not the use of HFOV.

In a case-controlled study of 118 PICU patients, risk factors for pressure ulcer development included edema, a PICU stay of more than 96 hours, positive-end expiratory pressure (PEEP), weight loss, and an absence of routine position changes.[23] Neidig et al[18] found that in pediatric open-heart surgery patients, routine turning was not initiated until hemodynamic and respiratory stability were achieved because turning was not viewed as a priority. Furthermore, repositioning of the head was often limited by internal and external jugular catheters, edema of the head and neck, and air leakage around the endotracheal tube with movement,[18] issues also seen in the management of adult critical care patients.

Waterlow[15] identified the pressure from medical devices, tubing, casts, and splints, as well as staff awareness of pressure ulcer risk, to be factors affecting patient risk. In fact, many clinicians believe that pressure ulcers are not a problem in the pediatric population. This belief becomes a major risk factor because the skin may not be assessed and prevention measures may not be implemented.[24]

Among 227 patients with spina bifida, high paraplegia, high sensory impairment, being mentally challenged, large head circumference, scoliosis, kyphosis, an abnormal neurologic examination of the upper extremities, and chronic fecal or urinary incontinence were also associated with pressure ulcer development.[20] In a retrospective, exploratory study of 69 pediatric outpatients with myelodysplasia and cerebral palsy, paralysis, insensate areas, high-activity patterns, and immobility were identified as risk factors.[21]

RISK ASSESSMENT SCALES

Although there is no agreement on which risk factors contribute to pressure ulcer development in neonates and children, there is agreement that prevention lies in early risk identification.[11] Currently, there are 10 published pediatric pressure ulcer risk assessment scales[3,8,9,17,25–32] (Table 1). Of these scales, only the Braden Q Scale, the Glamorgan Scale, and the Neonatal Skin Risk Assessment Scale (NSRAS) have been tested for sensitivity and specificity.[8,9,18,30,31]

The Braden Q was developed for pressure ulcer risk identification in children aged 21 days to 8 years.[8,9] The Braden Q contains the original 6 subscales of the Braden scale for adults and a seventh subscale for tissue oxygenation and perfusion. Additionally, subscale descriptors were modified to make them more developmentally appropriate for the pediatric population.[8,9] Having undergone predictive validity testing among 322 PICU patients, the Braden Q was found to be 88% sensitive and 58% specific at a cutoff score of 16.[8,9] Patients with cardiac shunting or unrepaired congenital heart disease were excluded from this sample, limiting its generalizability.[8,9] Additional studies are needed among pediatric populations outside of the PICU and with greater racial representations.

The Glamorgan Scale was based on a review of the literature, feedback from clinical experts, and data analyzing characteristics of 1 hospitalized pediatric patients with pressure ulcers and 275 without ulcerations.[30,31,33] The Glamorgan Scale has 11 statistically significant pediatric pressure ulcer risk factors:[30,31,33]

- inability to move without great difficulty or deterioration in condition or having prolonged surgery
- inability to change position without assistance/inability to control body movement
- some mobility, but reduced for age
- equipment/objects/hard surface pressing or rubbing on skin
- significant anemia (hemoglobin < 9 g/dL)
- persistent pyrexia (temperature > 37.5C for more than 12 hours)
- poor peripheral perfusion (cold extremities/capillary refill > 2 seconds/cool mottled skin)
- inadequate nutrition (unable to take/not absorbing oral or enteral feeds and not supplemented with hyperalimentation)
- low serum albumin level (<3.5 g/dL)
- weight < 10th percentile
- incontinence (if inappropriate for age)

At a cutoff score of 15, the Glamorgan Scale has been found to be 98.4% sensitive and have a specificity of 67.4%.[30,31] An international, multicenter study examining the interrater reliability of the Glamorgan Scale is currently in progress.

The NSRAS, also modeled after the Braden Scale, measures 6 subscales pertinent to neonates and is based on gestational age.[17] Reliability and validity testing of the NSRAS was performed with 32 NICU patients (aged 26 to 40 weeks of gestation).[17] Three subscales (mental status, mobility, and moisture) were deleted because of low interrater reliability.[17] Using only the subscales of general physical condition, activity, and nutrition, and having a cutoff score of 5, sensitivity was 83%, specificity was 81%, and interrater reliability was 97%.[17]

Table 1.

NEONATAL AND PEDIATRIC PRESSURE ULCER RISK ASSESSMENT TOOLS

Author	Tool	Based on	N	Setting	Age	Sensitivity	Specificity
Barnes[27]	Barnes	Literature review	None specified	Pediatric acute care	Not specified	Not performed	Not performed
Bedi[28]	Bedi	Adult Waterlow	None specified	PICU Progressive care unit	Neonate to >age 12	Not performed	None
Cockett[32]	Cockett	Literature review	None specified	PICU	Not specified	Not performed	None
Garvin[3]	Garvin	Not specified	None specified	PICU	Not specified	Not performed	None
Huffiness and Lodgson[17]	NSRAS	Adult Braden	32	NICU	24–40 weeks of gestation	81%	81%
Olding and Patterson[25]	Pattold Pressure Scoring System	Literature review Key components for maintaining skin	None specified	PICU	Not specified	None	None
Pickersgill[26]	Derbyshire	Medley & Adult Waterlow	None specified	Not stated	Not specified	No	None
Quigley and Curley[8,9]	Braden Q	Adult Braden Expert panel	322	PICU	21 days–8 years	88% (modified version 92%)	58% (modified version 59%)
Waterlow[29]	Pediatric Waterlow	Pediatric pressure ulcer risk factor identification and incidence study (Waterlow)	302	Pediatric acute care	Neonate-16 years	None	None
Willock, Anthony, and Baharestani[30,31]	Glamorgan	Literature review Expert panel Pediatric pressure ulcer risk factors study (Willock)	336	Pediatric acute care	Birth-18 years	98.4%	67.5%

Source: Baharestani MM. Wounds in special populations: neonatal and pediatric populations. In: Baranoski S, Ayello EA, eds. Wound Care Essentials: Practice Principles. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; (in press).

Despite low reliability, Huffiness and Lodgson[17] suggest using the scale with all subscales because all are considered important in determining the neonate's risk. Limitations of the NSRAS include a small sample size (of which 84% were white), the need for further clarification in subscales' operational definitions, and improved reliability.

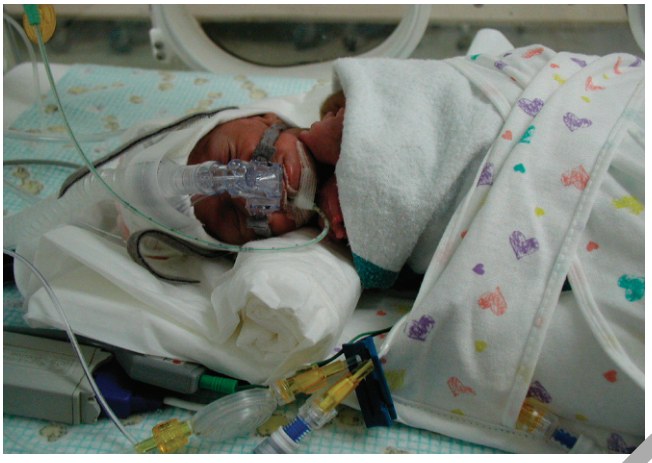
PATIENT AND WOUND ASSESSMENT

On admission, all neonates and children should have a documented comprehensive examination, including a skin assessment and a risk assessment for pressure ulcers. Pressure ulcer risk assessment should be performed at least daily with a documented head-to-toe skin assessment. Thorough examination of high-risk areas, such as under splints, braces, traction boots, tracheostomy plates, and arm boards, is critical. Patients receiving continuous positive airway pressure (CPAP) need close assessment and monitoring of the nares and septum. If pressure ulcers are noted, location, size, undermining, tunneling, drainage, necrotic tissue, epithelialization, stage, and surrounding skin status should be documented.[58] Stage I to IV pressure ulcers, pressure ulcers that cannot be staged, and suspected deep tissue injuries should be documented in accordance with National Pressure Ulcer Advisory Panel (NPUAP) defintions.[59]

PRESSURE REDISTRIBUTION

Among neonates and children, more than 50% of pressure ulcers are related to equipment and devices[34] (Figures 1 and 2). Frequent skin assessments under blood pressure cuffs, transcutaneous oxygen pressure probes, tracheostomy plates, nasal prong and mask CPAP, arm boards, plaster casts, and traction boots are important preventive measures. Orthotics, wheelchairs, and wheelchair cushions must be frequently readjusted in growing children. Beds, cribs, and isolettes must be inspected to ensure that tubing, leads, toys, and syringe caps are not under or on top of patient's skin.[34] The skin around nasogastric and orogastric tubes, head dressings, and hats should be assessed for pressure damage.

Figure 1.
MASK CPAP



Children are frequently placed on support surfaces designed for adults, although the efficacy and safety of this practice are unknown.[3,10] Low-air-loss beds designed for adults cannot accommodate the height and weight of infants and small children.[35] The feet, elbows, and buttocks of infants and children often sink into and in between the cushions of the mattress.[35] Adult specialty beds placed in the turn mode result in the occiput of small children pivoting on the same pressure point, increasing shear and friction.[23] If a low-air-loss bed or alternating overlay is indicated, it should be age-appropriate and safe, and it should be used in accordance with manufacturer's recommendations. In 2 small studies in which a total of 26 high-risk PICU general acute, and home care patients used pediatric-designed, alternating mattress replacements, no pressure ulcers developed.[10,37]

Support surfaces of gel and foam inadequately relieve heel pressure and the friction- and shear-related forces of reciprocal kicking.[38] Customized splinting provides total pressure relief while allowing for an infant's lower limb developmental mobility.[38]

A variety of support surfaces such as preinflated, air-filled chair cushions designed for adults[39]; sheepskin[40,41]; water pillows and mattresses[40,42]; varying compositions of foam; hydrogel dressings; sectional viscous fluid mattresses designed for adults (taken from adult operating table pads)[43]; and gel pillows and mattresses have been cited in the neonatal literature. However, many of these products do not have the clinical studies to support their efficacy.

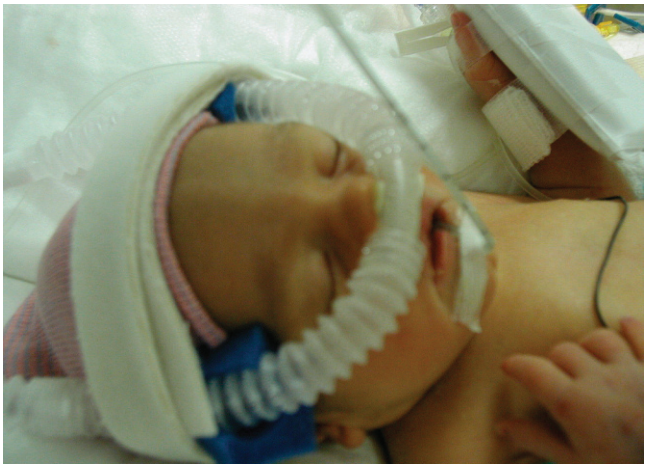
Based on expert opinion, water, air, and gel mattresses and sheepskin and gel pads placed at the joints, behind the ears, and behind the occiput are recommended by Lund[44] and the Association of Women's Health, Obstetric and Neonatal Nurses (AWOHNN)[4] for pressure ulcer prevention in neonates of less than 32 weeks of gestation.

In surveys of 518 NICUs, 77% to 83% of neonates were placed on sheepskins for pressure ulcer prevention and treatment[45,46] and were repositioned at least every 4 hours.[46] In adult populations, the standard of care is to reposition every 2 hours, but repositioning premature infants at this frequency can result in agitation, apnea, bradycardia, emesis, airway obstruction, hypoxemia, tachycardia, and slower oxygenation recovery times.[5,47]

In a randomized, prospective study, 72 premature infants in the NICU on either viscoelastic foam (VEF) or a gel mattress developed no pressure ulcers over an 8-month period.[48] Neonates on the VEF maintained body temperature more easily and exhibited more normal cranial bone development than those on the gel mattress.[48] Fourteen children with muscular dystrophy using urethane foam in their wheelchairs more than 10 hours a day developed no pressure ulcers over a 10-month period.[49] Ischial pressure ulcers in 2 participants healed during the study.[49]

Alternating pressure overlays, low-air-loss beds and overlays,[9] gel pads and mattresses, air-filled wheelchair cushions designed for adults,[50] wheelchair push-ups,[50] heel suspension off the bed using pillows,[9] padding under splints and inside traction boots, regular turning,[29] air fluidized beds,[9] and viscous fluid mattresses[43] have all been recommended for children at risk for pressure ulceration. Unfortunately,

Figure 2.
NASAL CPAP



evidence-based criteria for selecting pressure redistribution sleep surfaces do not exist for children nor adults.[9]

In healthy small, young children, the highest interface pressures are under the occiput; in older, larger children, the highest pressures are in the sacral area.[51] In 2 separate studies, 2- to 4-inch convoluted foam was shown to effectively decrease these pressures.[51,52] In healthy children younger than age 2 years, the use of a foam overlay resulted in low interface occiput pressures.[52] In children older than age 2 years, a foam overlay and a gel pillow placed under the head significantly reduced occipital pressures.[52]

Support surfaces and positioning devices are adjunctive to manual pressure redistribution.[36] Among children undergoing open heart surgery, a 3.4-fold decrease in occipital pressure ulcers was reported when a 1.5-inch foam cushion was placed under the head in the operating room and then head repositioning was done every 2 hours in the PICU.[18] In addition, using a positioning schedule and placing a gel pad over the occipital region resulted in the elimination of pressure ulcer formation and scarring alopecia in PICU patients on extracorporeal life support.[53]

TOPICAL TREATMENT

Selecting topical agents for pediatric populations requires consideration of patient age, degree of integumentary maturity, skin condition, product adherence, skin sensitization, and toxic potential of the product.[54,55] Knowing the manufacturer's recommended use of the product in the neonatal and pediatric population is critical.

WOUND CLEANSING

Sterile water and normal saline are the most commonly recommended cleansing agents for pediatric wounds,[4,41,56,57] with sterile water being preferred for neonates.[41] These cleansers should be warmed to body temperature for neonates, and normal saline should be diluted 1:1 with sterile water.[4,41,57] Use of a 20-mL syringe with a blunt needle or a polytetrafluoroethylene (Teflon) catheter is recommended to gently flush away wound exudate.[4] Antiseptics should be avoided because of their potential for tissue damage and absorption.[4,56,57]

DEBRIDEMENT

Necrotic tissue should be debrided using a method consistent with the overall goals of care. Anecdotal case reports of topical enzyme use have been documented in pediatric patients, but manufacturers recommend use only in those over age 18 years. Safety data for younger patients are not available. According to adult guidelines,[58] when a stable eschar is overlying the calcaneal region without signs of infection, pressure should be relieved and the eschar should be left alone to serve as its own biologic covering. In the presence of clinical signs of infection and adequate perfusion, calcaneal eschars should be debrided.[58] Guidelines for managing heel pressure ulcers in neonatal and pediatric populations are lacking.

MANAGING BACTERIAL COLONIZATION AND INFECTION

When extensive colonization is suspected, antibiotic ointments such as mupirocin nasal treatment, polymyxin B, or bacitracin zinc-polymyxin B may be sparingly applied every 8 to 12 hours[4]; such therapy decreases the risk of allergic contact dermatitis.[4] Generally, bacitracin zinc-neomycin-polymyxin B ointment is not suggested because of the potential for ototoxicity and future sensitization.[44] Although useful in treating gram-positive bacteria, bacitracin, mupirocin, and bacitracin zinc-polymyxin ointment may promote the growth of gram-negative organisms.[44] In wounds suspicious for infection, obtain cultures and Gram stains.[44]

Given a lack of research and the potential for toxicity, silver sulfadiazine cream is discouraged for neonates.[4,44] In an audit, 8 premature infants between 23 and 28 weeks of gestation treated with nanocrystalline silver dressings were found to have achieved reepithelialization by day 28.[60] In 3 neonates, serum silver levels were measured; 2 were < 0.05 micromol/L, and 1 was 1 micromol/L, where silver sulfadiazine had been previously used for 24 hours. The timing of the serum level draws was not reported.[60] Similarly, a 26-week premature neonate's dehisced abdominal wound was successfully closed by secondary intention with an ionic silver dressing covered by a hydrocellular foam and transparent film dressing.[61] Further research in this critical area is needed.

DRESSINGS

Several products have been tested on the skin, but few have undergone clinical testing when used in the open wounds of children, especially neonates.[45] Product selection in these populations has been based on anecdotal data, limited case series, institutional or individual preference, and predominantly extrapolation of adult-based guidelines.[2,55]

In 2001, AWHONN[4] released evidence-based, skin care guidelines for neonates less than 32 weeks of gestation. Recommendations for noninfected ulcers included using hydrogels, hydocolloids, and film dressings.[4] For infected ulcers, sheet hydrogels can be combined with topical antibacterial or antifungal ointments, but they must be changed every 6 to 8 hours if the neonate is in a warmer because the dressing will dessicate.[44] To prevent conductive heat

transfer, hydrogels can be warmed to body temperature in the neonate's incubator or radiant warmer.[57] If moistened gauze is used as the primary dressing layer, a nonwoven formulation is recommended because it is less abrasive to healing epithelium.[44]

Other recommendations from AWOHNN include the following:[4]

- Avoid products not currently recommended for neonates.
- Use pectin barriers or hydrocolloid adhesive products as barriers when tape must be used.
- Use tubular stretchy gauze to secure nonadhesive dressings.
- Apply alcohol-free skin protectants to the intact skin of term infants >30 days of age that may be subjected to fluids, adhesive products, and friction.
- Slowly remove adhesives and gently use cotton balls soaked with warm water.
- Avoid solvent adhesive removers and bonding agents.
- Avoid products containing dyes, perfumes, and preservatives. Propylene glycol, a common preservative in the liquid base of many wound care products, can cause irritation, resulting in contact dermatitis.[62]

The skin of premature neonates of less than 37 weeks of gestation is prone to the absorption of topical products and has an increased risk of skin infection and an increased risk of transepidermal water losses from the skin. Before 37 weeks, premature skin is also prone to pressure as well as shear and frictional forces.[55] After 37 weeks, there is better barrier function of the skin with less water loss and drug absorption, but the age at which percutaneous absorption is no longer a risk among more mature infants and children is not known.[55]

Most pediatric dressing selection algorithms are based on the basic principles of cleansing, debridement, eradication of infection, absorption of excessive moisture, obliteration of dead space, maintenance of a moist environment, protection from trauma and bacterial invasion, insulation, protection against percutaneous toxicity, and pain management,[44,63] modeled after the pressure ulcer treatment guidelines from the Agency for Health Care Policy and Research (AHCPR).[3,9,58]

The most commonly recommended dressings for pediatric pressure ulcer treatment include the following:[3,9,43]

- hydrocolloids
- sheet and amorphous hydrogels
- transparent films
- polyurethane foams
- gauze.

The use of calcium alginates is recommended in selected algorithms,[3,9] but there are concerns about the potential systemic absorption of calcium and sodium.[57] Anecdotal case reports of hydrofiber use have been described in the management of neonatal and pediatric extravasation, burns, and orthopedic wounds. Bilayered cellular matrix has been reported to achieve rapid closure of a denuded hip wound in a 23-week-old infant.[64] However, cautions have been raised regarding the use of bovine collagen in those with known sensitivity and in neonates because of their immature immune system.[57] Silicone dressings, which are newer to the market, offer prophylactic protection from pressure ulcer development under CPAP masks,[65] maintenance of a moist wound environment, and atraumatic removal. Clinical outcome studies of the product in treating pressure ulcers are needed.

ADJUNCTIVE THERAPY

A clinical series of 51 children successfully treated with negative pressure wound therapy (NPWT) as delivered by V.A.C. (KCI, Inc, San Antonio, TX) was reported by Caniano et al.[66] Nine patients with perineal and extremity ulcers in this series received NPWT for an average of 8 days.[66] Successful grafting and flap closure was achieved by 8 of 9 patients.[66] Skin graft failure in 1 patient required an additional NPWT application and flap closure.[66] Development of clinical guidelines for managing pediatric wounds with NPWT is in progress. Further studies examining the clinical outcomes of pediatric pressure ulcers treated with NPWT are needed.

MINIMIZING RISK WITH NUTRITIONAL CONSIDERATIONS

An estimated 15% to 20% of patients admitted to the PICU are malnourished.[67] In a sample of 18 hospitalized children with pressure ulcers, none were found to be receiving adequate nutrition.[34] However, the role of nutrition in preventing and managing pressure ulcers in pediatric patients has not been studied.

The systemic and immunologic effects of malnutrition on this compromised population further limit their tissue tolerance to pressure, frictional forces, and shear, especially as third spacing from hypoalbuminemia develops.[36] A comprehensive nutritional assessment addressing risk factors and protein, hydration, caloric, and vitamin needs is essential to a pressure ulcer prevention and treatment plan of care.[36]

PAIN MANAGEMENT

Integral to every wound assessment should be an assessment of pain.[56] The importance of effective pain management in children with wounds is often underestimated.[68] Practical, valid, reliable pain measuring tools to assess pressure ulcer pain are needed in the clinical care of pediatric patients. Three tools that have been tested for reliability and validity are CRIES (cry, requires oxygen, increased vital signs, expression,

sleeplessness); CHIPPS (children's and infants' postoperative pain scale); and NIPS (neonatal infant pain scale).[69] However, the use of these or other tools to assess pressure ulcer pain in the neonatal or pediatric population could not be found in the literature.

PALLIATIVE CARE

Although advances in health care have increased infant survival rates, more infants die in the neonatal period (birth to 27 days of life) than at any other time in childhood.[70] During care of neonates and children at the end of life, pressure ulcer prevention and treatment measures should be realistic, sensitive to, and consistent with family wishes and overall goals of care. Selection of pressure redistribution support surfaces, frequency of turning and repositioning, pain management, and dressing selection need to focus on patient comfort and dignity. Aggressive debridement is inappropriate. Small position shifts can be provided for pressure redistribution and comfort, with full turns tailored to the individual patient. Allow children to maintain an active role in decision making, such as the foods they want and the timing of their analgesic administration and dressing changes. Provide gentle explanations of procedures to the child and parents. Holistically attend to the physical, psychological, emotional, and spiritual needs of patients and parents.

Guidelines for pressure ulcer prevention and treatment are needed for neonatal and pediatric patients receiving palliative care.

SUMMARY

Based on pressure ulcer prevalence and incidence data, neonates and children are at risk for and do develop pressure ulcers. Products manufactured to prevent and treat pressure ulcers among adults may not be suitable for children and neonates. Skin breakdown in pediatric patients can result in pain, infection, disfigurement, altered body image, and mortality, as well as increased costs, length of stay, and litigation. Further research is needed to optimize the pressure ulcer prevention and treatment provided to this population.

QUESTIONS

With a modified list of questions developed by the Wound, Ostomy & Continence Nurses Society (WOCN) Pressure Ulcer Guideline Panel[1] as a template, an evidence-linked neonatal and pediatric pressure ulcer prevention and treatment guideline could evolve. Specific questions to be addressed include, but are not limited to, the following:

- What are the unique risk factors for development of pressure ulcers? (high-risk groups)
- Which risk assessment scales should be used and what are the cutoff scores for identifying risk?
- Should different scales be used for neonates and children?
- When should risk assessments be performed?
- How often should reassessments be performed?
- What are the prevalence and incidence of pressure ulcers? (based on a standardized staging system and a consistent data collection methodology, identified by setting, such as acute care, outpatient, and acuity, such as critical care)
- What are distinct assessment factors for this population? (nutrition, support surfaces, continence management, comorbid conditions)
- What are the safest and most efficacious therapies to treat pressure ulcers in the neonatal and pediatric populations? (wound cleansers, topical dressings, topical antimicrobials, debridement methods, adjunctive therapies)
- How is pain associated with pressure ulcers assessed and managed?
- What is the role of surgery in treating pressure ulcers?
- Which methods or tools are used to assess healing of pressure ulcers?
- Which factors are most influential in recidivism of pressure ulcers?
- What pressure ulcer prevention and treatment education is provided and how is it delivered to clinicians, ancillary health care providers, patients, and family caregivers?
- Which quality monitoring programs are in use and how are results disseminated?
- What is the role of palliative care and does it differ from palliative care for adults?

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