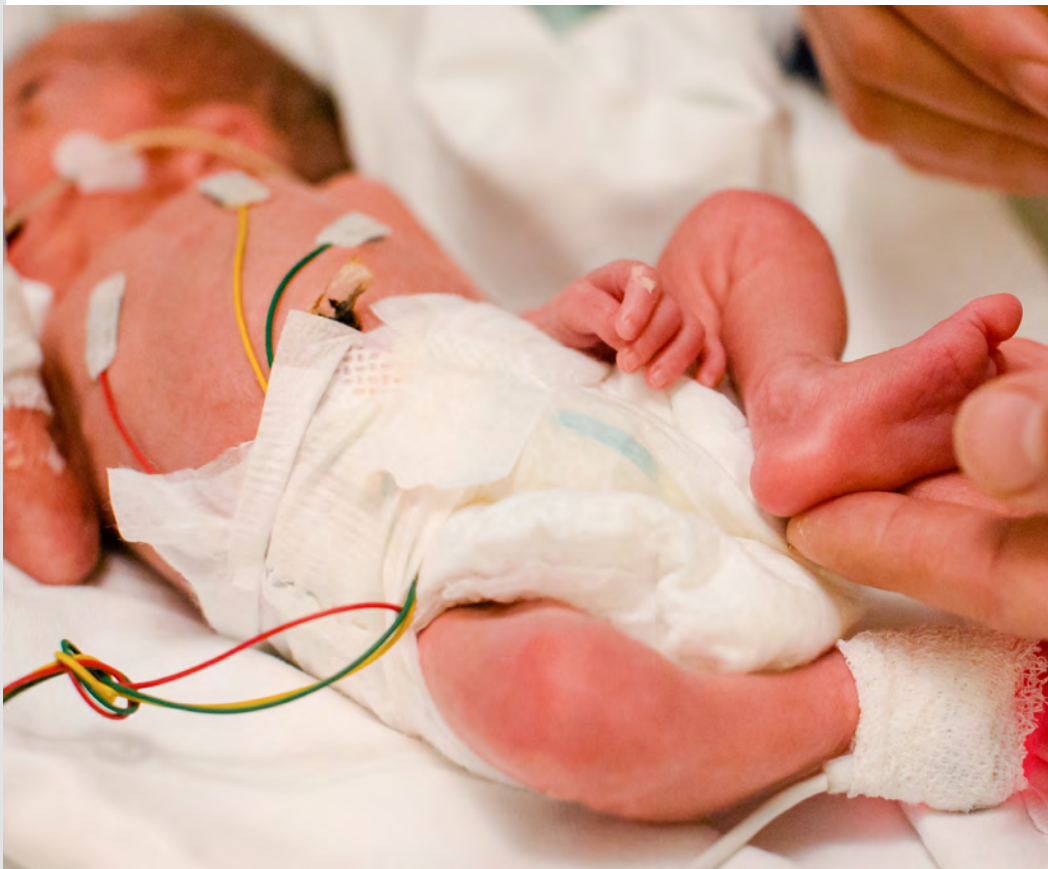
In This Section

IV. Skin Considerations and HAI Prevention

Introduction

The condition of the skin is an important consideration in the prevention of hospital acquired infection; especially for the extremely low birthweight infant as their skin is significantly underdeveloped and provides little protection from the surrounding environment. The burden of infection is inversely related to gestational age with the youngest and most immature infants experiencing a higher incidence of late onset infection.[32, 33]

The skin of premature and full-term neonates has several unique anatomic and functional differences that puts them at risk for injury from the skin disinfectants and medical adhesives used for insertion and securement of central venous catheters in the neonatal population. Although the full-term infant has sufficient barrier function provided by the stratum corneum and basal layer of the epidermis, this layer is not a fully formed compared to older children and adult skin. The dermis is also not fully formed.[1]
The premature infant has fewer layers of the uppermost layer of the



epidermis, the stratum corneum, resulting in increased evaporative heat and water loss. In addition, the entire epidermis is attached to the dermis with proteinaceous fibrils which are fewer in number and more widely spaced in the premature infant, placing them at risk for stripping of the epidermis from adhesive removal and potential chemical burns from skin disinfectants.[2]

Active treatment of infants born at 22-23 weeks increases the need for specific, evidence-based care protocols that reduce skin injury, improve skin barrier function, and reduce hospital acquired infection. [34-37]

POTENTIALLY BETTER PRACTICE

Disinfect skin surfaces before insertion of central venous and arterial catheters including umbilical catheters and percutaneously inserted central catheters (PICCs)

Background, Rationale, and Goals

- Central catheters risk development of hospital acquired bloodstream infections
- Infections arising from insertion and dressing changes are considered an extraluminal source of infection and can be prevented by careful skin preparation with disinfectants
- Infections from an intraluminal source can be prevented by strict adherence to aseptic technique for catheter hubs, caps, connectors, and IV tubing[4]

Outcome, Balancing and Process Measures

- Number of CLABSIs occurring within the first week from insertion (extraluminal course)

POTENTIALLY BETTER PRACTICE

Select a Disinfectant by Evaluating Risks and Benefits of Each Product Relative to Efficacy, Potential for Toxicity, and Skin Irritation

Background, Rationale, and Goals

- Available products include:
  - Chlorhexidine gluconate (CHG), usually mixed with 70% isopropyl alcohol (although an aqueous formulation is also available but not in single use packaging)
  - 10% povidone iodine
  - 70% isopropyl alcohol
- There is insufficient evidence to recommend a single product for all neonates[31]
- Isopropyl alcohol is the least effective disinfection compared to CHG or povidone iodine[5]
- CHG containing disinfectants have been shown to reduce contaminated blood cultures in pediatric patients[6]
- Systemic toxicity can occur if skin disinfectants are absorbed through the skin
- Povidone iodine has been shown to alter thyroid function in some premature infants, although this effect appears to be transient[7,8]
- CHG can also be absorbed, with some studies showing measurable levels of CHG in serum, although no toxicity has been reported at this time[9,10]
- Use of daily CHG wiping or bathing as a method to reduce HAI carries a risk of significant absorption and until it is known whether CHG crosses the blood/brain barrier, this practice has not been determined to be safe in neonates[11]
- Skin irritation, chemical burns or erosive contact dermatitis have been reported from skin disinfectants
- Reports are seen primarily with CHG preparations, generally with those that contain 70% isopropyl alcohol, but some injuries have also been reported with aqueous preparations[12-16]
- Infants born earlier than 32 weeks' gestation who require skin disinfectants in the first two weeks of life are at greatest risk for these skin injuries

Outcome, Balancing and Process Measures

- Report and track any skin injuries from skin disinfectants

POTENTIALLY BETTER PRACTICE

Standardize Dressings and Securement Techniques that Minimize Catheter Migration and Extraluminal Introduction of Microorganisms Along the Tract of the Catheter

Background, Rationale, and Goals

- Transparent adhesive dressings (TADs) allow for direct visualization of the insertion site, are semi-occlusive, and prevent catheter migration, especially when used to secure PICCs
- TADs should be changed when the dressing has lifted/detached on any border edge or within the transparent portion of the dressing [31,38, 39]
- For NICU patients, PICC dressings should be changed when dressing integrity is compromised, since dressing changes can result in catheter migration and cause skin disruption from adhesive removal [40]
- Dressing changes are best done by two people using standardized sterile technique; using a dressing change kit will facilitate the process and save time
- External catheter length measurements are advised to determine if catheter migration has occurred
- If there is bleeding at the insertion site, use a sterile hemostatic agent to promote adherence and prevent catheter migration. If the agent or blood obscures the insertion site, the dressing should be changed after 24 hours
- Clear tissue adhesives formulated with cyanoacrylates can be applied to the insertion site prior to placement of the TAD. There is a paucity of published research on the use of tissue adhesives in the NICU population. Potential benefits of these products used in adult and pediatric patients include prevention of catheter migration, barrier to microorganisms at the insertion site, and hemostasis. These should be applied with initial dressing application and with dressing changes [41]

Recommended Guidelines and Algorithms

- Standardize techniques for dressing changes to reduce variability. An example of a PICC dressing standardization visual aid is included under Tools.

Guidance on Quality and Process Improvement

- Audit central venous catheter (CVC) dressings regularly to improve adherence to standardized techniques.

POTENTIALLY BETTER PRACTICE

Use Products and Techniques to Minimize Risk for Medical Adhesive-Related Skin Injury (MARSI)

Background, Rationale, and Goals

- Injuries from medical adhesives include epidermal stripping, skin tears, blistering and contact dermatitis [17-21]
- To prevent skin stripping and skin tears use a silicone, non-alcohol skin protectant under TADs used as dressing for CVCs [22]
- Use a silicone based adhesive remover to facilitate removal of TADs and other medical adhesives [23]
- Avoid the use of adhesive enhancing “tackifiers” as these make the bond between epidermis and adhesive stronger than the bond between epidermis and dermis, increasing the likelihood of epidermal stripping [5]
- Remove TADs and other medical adhesives by pulling the adhesive parallel to the skin surface and gently holding the skin down during removal [5]
- Contact dermatitis can occur with some TAD products. Switching to a different product can resolve contact dermatitis in most cases[19,21]
- Reduce the number of breaks in the skin from peripheral IV attempts as this may reduce the risk of HAI, especially in preterm infants for which the skin is a clear portal of entry for bacteria. Consider adopting a Difficult Intravenous Access (DIVA) tool or another algorithm to guide practice [42-45]

Guidance on Quality and Process Improvement

- Report all MARSI as unusual occurrences
- Report any MARSI related to CVC securement

POTENTIALLY BETTER PRACTICE

If Skin Injury is Evident and Physical Findings of Skin Infection are Present (Drainage, Redness) in Extremely Low Birthweight (ELBW) Patients with CVCs in the First Weeks of Life, Obtain Skin Culture to Identify Microorganisms that are Colonizing the Skin

Background, Rationale, and Goals

- If pathogens are present, consider sending a blood culture for bacteremia
- Topical antimicrobial and anti-fungal ointments or creams can be used on areas of skin breakdown, along with silicone dressings[5]
- Medical grade honey has anti-infective effects and can facilitate healing of skin breakdown[24-26]
- Dressings containing silver have been used for skin breakdown in premature neonates[27]
- If skin breakdown is excessive and colonized with candida albicans, consider systemic treatment with antifungal agent to prevent bacteremia[28,29]

Guidance on Quality and Process Improvement

- Early identification of microorganisms colonizing the skin may prevent systemic infection or guide antimicrobial selection when suspecting sepsis

Resources and Tools

Tools

The following tools are included in this section:

1. PICC Dressing Change Steps
2. Audit Tool for Dressing Integrity/Changing
3. Difficult Intravenous Access (DIVA) Policy and Pathway Tool

PICC DRESSING CHANGE STEPS

SOURCE: UCSF Benioff Children's Hospital San Francisco

DRESSING CHANGE PROCEDURE

- If dressing is intact immediately and *completely* surrounding insertion site (and Biopatch or port needle):
  - It is acceptable to reinforce a non-intact edge with tape (e.g., Medipore H or Multipore Dry)
  - Application of Cavilon barrier film to the skin prior (except with IV Clear) will help with adhesion.
  - Do not add an additional layer of transparent dressing over original dressing. This will trap moisture and may result in skin irritation or breakdown.
- If dressing becomes soiled with emesis, urine, stool or secretions:
  - Clean off visible debris from dressing and surrounding area with dry or saline wipes, followed by CHG.
- Change dressing if it has become non-occlusive, damp or soiled as soon as possible (i.e., within the hour).
- If insertion site or surrounding skin is bleeding, oozing or weeping, change dressing (after being left intact for 2 days since last noted to bleed, ooze or weep).
  - If continues to significantly bleed, apply gauze with transparent dressing, then change every two days.
  - If a more minor bleed/ooze, apply hemostatic agent (e.g., StatSeal), and if dry but at risk for bleeding, consider using SecurePort IV tissue adhesive.

Type of Catheter	Dressing Components	Minimum Dressing Change Frequency
PICC (< 2 mos/48 wks corrected age)	Transparent dressing only	PRN
Tunneled, Non-Tunneled (all pt > 27 weeks GA, > 1000 gms & > 7 days of age) **PICC** (> 2 mos/48 wks corrected age)	Biopatch® and transparent dressing	Every 7 days
Tunneled, Non-Tunneled, PICC (all ages)	Gauze and transparent dressing	Every 2 days
Tunneled, Non-Tunneled, PICC (> 2 mos/48 wks corrected)	Transparent dressing only	Every 7 days
Implanted Vascular Access Port	Transparent dressing	Every 7 days (+ needle change)

AUDIT TOOL FOR DRESSING INTEGRITY/CHANGING

SOURCE: University of California, Irvine (UCI) Health

PICC Dressing Daily Audits

(✓) Dressing intact/per protocol (*) drsg not intact; see comments (education, redressed, not secure, etc.)

June

Pt. Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Totals																															

Comments:

(✓): transparent dressing intact/not lifting

DIFFICULT INTRAVENOUS ACCESS (DIVA) POLICY AND PATHWAY TOOL - PAGE 1

SOURCE: UCSF Benioff Children's Hospital Oakland

TITLE: DIVA (Difficult Intravenous Access)	
BCHO NICU PATIENT CARE STANDARDS	**NICU PROTOCOL**
POLICY OWNER(S): Manager, NICU	**LAST APPROVAL:**
RESPONSIBLE OFFICE: NICU Nursing	**EFFECTIVE DATE:** April 2021
SCOPE: BCHO NICU Registered Nurses (RNs), BCHO Vascular Access Team	

PURPOSE

To outline the NICU Nursing practice of objectively assessing the potential for successfully PIV placement in NICU patients. To reduce the number of potential painful procedures during hospitalization.

LEVEL

Interdependent (*requires provider order)

CRITICAL POINTS

1. Establishing intravenous access in the neonatal population is a challenge for the NICU nurse.
2. Treatment delay, infiltration or inadequate intravenous access may result from the inability to properly assess and place the appropriate access in a patient.
3. These issues may be compounded by such factors as age, underlying disease, and disease chronicity.
4. The DIVA (Difficult Intravenous Access) Scoring system was first introduced to assist nurses in emergency departments to identify and assess patients who may be more difficult to access. It is now a clinically proven tool used to assess difficult intravenous access (DIVA) in both the adult and pediatric populations.

HISTORY of BCHO NICU DIVA Trial

- **Phase I:** To review factors that may predict difficult intravenous access (DIVA) in the neonatal population in the NICU at UCSF Benioff Children's Hospital Oakland and to develop a simple scoring tool that clinically identifies a neonate with difficult intravenous access.
- **Phase II:** Following development and validation of the BCHO Neonate DIVA Scoring Tool, an IV Access Pathway will be developed.
- **Goal:** Implementation of the BCHO Neonate DIVA Scoring Tool will increase the success rate of IV placement by the NICU nurses and decrease the number of venipuncture attempts to the patient.
- **Outcome:** The BCHO NICU DIVA Tool was adapted from the DIVA score studied in pediatric emergency departments. After four months of trialing the DIVA Tool, it proved to be a welcome approach for NICU nurses. Fewer unsuccessful attempts at placing IVs resulted in better neurodevelopmental NICU care and the preservation of veins in NICU patients.

DIFFICULT INTRAVENOUS ACCESS (DIVA) POLICY AND PATHWAY TOOL - PAGE 2

SOURCE: UCSF Benioff Children's Hospital Oakland

PROCEDURE

1. **IV ACCESS REQUIRED**
    a. Establish and confirm the need for PIV access.
2. **CONSIDER ALTERNATIVES to PLACING PIV:**
    a. PO route
    b. NG placement
    c. SQ/IM route
    d. E-PIV
    e. PICC/TCVC
3. **ASSESSMENT**
    a. Previous attempts
    b. Pre-op needs
    c. Length of treatment:
    d. E-PIV(5-7days)
    e. PICC/TCVC (>7 days)
    f. Frequent Blood Draws
    g. Hydration Status
    h. Analgesia Requirements
4. **CALCULATE DIVA SCORE:** Assign 0-2 points per predictor
    a. Visible Vein:
        i. Visible = 0
        ii. Not Visible = 2
    b. Palpable Vein:
        i. Palpable = 0
        ii. Not palpable = 2
    c. Length of Stay:
        i. 0-3 months = 0
        ii. 3-6 months = 1
        iii. >6 months = 2
    d. Current Weight:
        i. <1000 gm = 0
        ii. 1000 - 3000 gm = 1
        iii. >3000 gm = 2

DIFFICULT INTRAVENOUS ACCESS (DIVA) POLICY AND PATHWAY TOOL - PAGE 3

SOURCE: UCSF Benioff Children's Hospital Oakland

5. **TOTAL** the points for EACH of the four predictors:
    a. **DIVA SCORE = 0**
        i. RN **max 2** attempts
        ii. RN Superuser **max 2** attempts
        iii. Notify Neo/NNP & consider alternatives
        iv. Neo/NNP consult V.A.T.
    b. **DIVA SCORE = 1-2**
        i. RN Superuser **#1 max 2** attempts
        ii. RN Superuser **#2 max 2** attempts
        iii. Notify Neo/NNP & consider alternatives
        iv. Neo/NNP consult V.A.T.
    c. **DIVA SCORE ≥3**
        i. RN Superuser assess and considers NO attempts; or **max 2** attempts
        ii. Notify Neo/NNP & consider alternatives
        iii. Neo/NNP consult V.A.T.
6. **PLAN PAIN MANAGEMENT**: consider the following
    a. Oral Sucrose
    b. ELMAX > 6 mo.
    c. Child Life
    d. Procedural Sedation
7. CONSIDER **TOOLS FOR SUCCESS**:
    a. Ultrasound
    b. Vein Finder
    c. Transillumination
    d. Warm compress
    e. Movement
    f. Proper analgesia
    g. Proper sized catheter
8. Consult as indicated:
    a. DIVA Resource Champion
    b. RN PIV Superuser or PICC Inserter
    c. Provider
    d. Member of the Vascular Access Team

DIFFICULT INTRAVENOUS ACCESS (DIVA) POLICY AND PATHWAY TOOL - PAGE 4

SOURCE: UCSF Benioff Children's Hospital Oakland

DOCUMENTATION

- Document the DIVA Score in the IV Sticky Note.

RESOURCES

- **DIVA Resource Champions**:
  - NICU RNs with in depth knowledge of the tool. DIVA Resources participated in the DIVA trial and the education of NICU RNs in the use of the DIVA tool.
  - Vascular Access Team:
    - Lora Johnson, Anna Liang and Nina Rosche.
  - NICU RNs:
    - Kelly Keefe, Victoria Vetterli, Karen Simarro, Alison Gray, Mary Jane Levy, Vernaliza Largaespada, Jaime Croff, Kayla Hawkins, Mayra Gonzalez
- **RN PIV Superusers**:
  - Experienced NICU RNs with demonstrated competence in successfully placing IVs in NICU patients.

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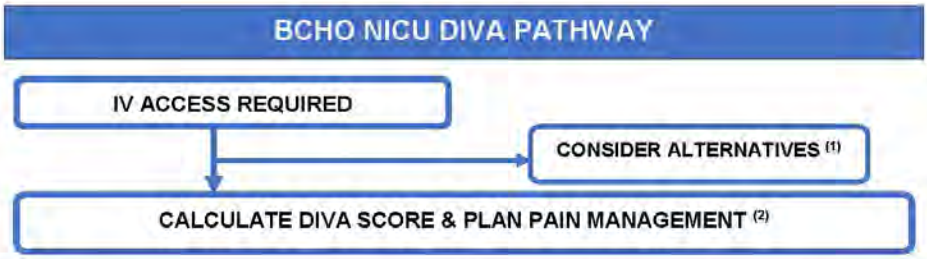
- https://journals.lww.com/advancesinneonatalcare/FullText/2014/12000/Peripheral_Intravenous_and_Central_Catheter.13.aspx

PROTOCOL HISTORY

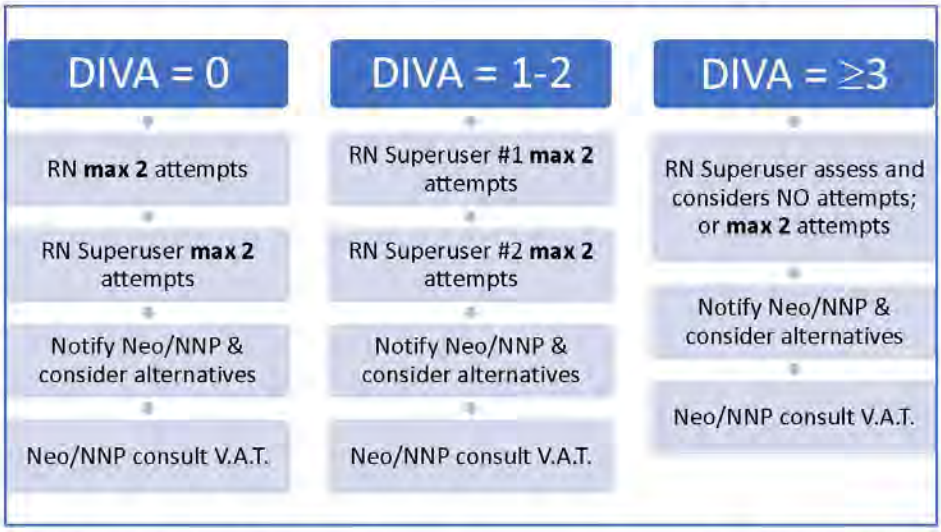
Originated/Approved:	Pam Koch RNIII & Vascular Access Team January 2021
Revised:	
Next Revision:	
Author:	Pam Koch RNIII & Lora Johnson PNP
Distribution:	NICU Nursing
Revision History:	

DIFFICULT INTRAVENOUS ACCESS (DIVA) POLICY AND PATHWAY TOOL - PAGE 5

SOURCE: UCSF Benioff Children's Hospital Oakland



Predictor	0 Points	1 Point	2 Points
Visible Vein	Visible	-	Not Visible
Palpable Vein	Palpable	-	Not Palpable
Length of Stay	0-3 months	3-6 months	> 6 months
Current Weight	<1000 gm	1000-3000 gm	>3000 gm
Total the points for EACH of the four predictors.		***DIVA SCORE =***	



(1) CONSIDER ALTERNATIVES	(2) PAIN MANAGEMENT	ASSESSMENT	TOOLS FOR SUCCESS

• PO route
• NG placement
• SQ/IM route
• E-PIV
• PICC/TCVC
	• Oral Sucrose
	• ELMAX > 6 mo.
	• Child Life
	• Procedural Sedation
		• DIVA Score
		• Previous attempts
		• Pre-op needs
		• Length of treatment:
		  ○ E-PIV(5-7days)
		  ○ PICC/TCVC (>7 days)
		• Frequent Blood Draws
		• Hydration Status
		• Analgesia Requirements
			• Ultrasound
			• Vein Finder
			• Transillumination
			• Warm compress
			• Movement
			• Proper analgesia
			• Proper sized catheter

** Adapted From: Riker, M. Validation and Refinement of the Difficult Intravenous Access Score. A Clinical Prediction Rule for Identifying Children with Difficult Intravenous Access. Academic Emergency Medicine. 2011:18: 1129-1134 and Children's Hospital at Montefiore IV Access Pathway*

BCHO NICU DIVA PROTOCOL

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