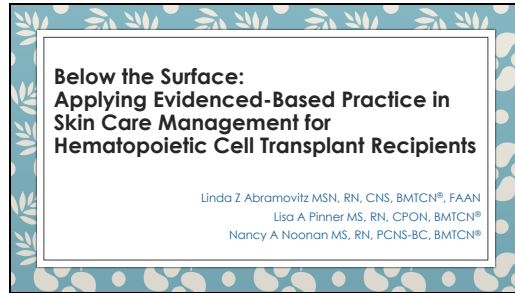


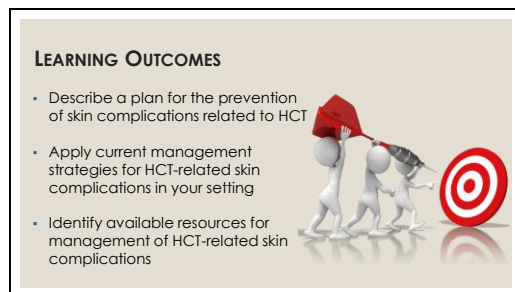
Slide 1




Slide 2



Slide 3



Slide 4



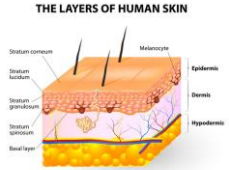
- Structure and Function
- Causes of Skin Complications
- Case Studies
 - Assessment
 - Interventions & Management
 - Skin Care Challenges & Solutions

Best Practices

Evidence-Based Knowledge

Slide 5

SKIN STRUCTURE AND FUNCTION



THE LAYERS OF HUMAN SKIN

Stratum corneum
Stratum lucidum
Stratum granulosum
Stratum spinosum
Basal layer

Melanocyte

Epidermis
Dermis
Hypodermis

The Royal Children's Hospital

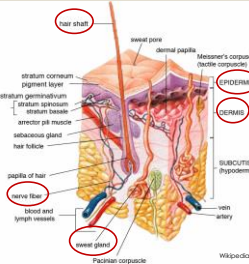
Skin Functions

- Natural barrier to prevent infection
- Regulates body temperature
- Regulates fluids and electrolytes
- Sensory processing

Alteration in Skin Integrity

- Increased risk of infection
- Fluid Loss
- Pain
- Negative body image
- Impaired temperature regulation

Slide 6



hair shaft
inner pore
dermal papilla
Merkel's corpuscle (tactile corpuscle)
stratum corneum
pigment layer
stratum granulosum
stratum spinosum
stratum basale
arrector pili muscle
sebaceous gland
hair follicle
papilla of hair
nerve fiber
blood and lymph vessels
sweat gland
Pacinian corpuscle

EPIDERMIS
DERMIS
SUBCUTIS (hypodermis)

vein
artery

Wikipedia


MANIFESTATIONS OF SKIN INJURY

- Alopecia
- Pigment changes
- Skin breakdown

Slide 7

RISK FACTORS FOR SKIN BREAKDOWN

- Hospitalization
- Impaired mobility/activity
- Nutrition
- Friction/shearing
- Moisture
 - Urine
 - Stool (diarrhea)
 - Diaphoresis
- Poor hygiene
- Non-adherence



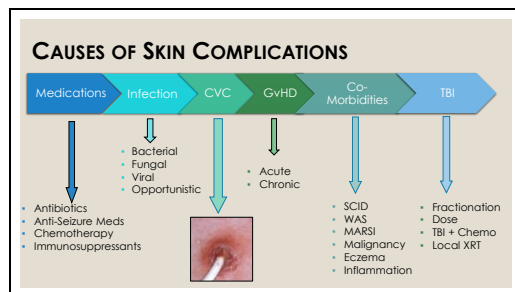
<https://www.bmrbt.org>

Slide 8

WHAT ARE THE POTENTIAL CAUSES FOR SKIN INJURY?



Slide 9



Slide 10

CAUSES OF SKIN COMPLICATIONS

Preparative Regimen Agents


- Cyclophosphamide
- Cytosine arabinoside
- Busulfan
- Thiotepa
- BCNU
- Melphalan
- Etoposide



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CUTANEOUS EFFECTS OF SELECTED PREPARATIVE REGIMEN AGENTS

AGENTS	REACTIONS
Cyclophosphamide	Acral erythema Hyperpigmentation of palms, soles, nails Onychodystrophy
Etoposide	Acral erythema Hyperpigmentation in occluded areas Radiation recall Alopecia
Thiotepa	Hypersensitivity reactions Hyperpigmentation in occluded areas Alopecia




Rosman (2008) J American Academy of Dermatology

www.clinicaladvisor.com

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Rosman (2008) J American Academy of Dermatology www.clinicaladvisor.com

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CAUSES OF SKIN COMPLICATIONS

Total Body Irradiation (TBI)

- Single dose vs fractionated
- Timing of TBI dosing
- Chemotherapy +/- radiation




Slide 15

WHAT IS MARS?


◦ **M**edical **A**dhesive **R**elated **S**kin **I**njuries

◦ Damage to the skin that may occur when medical adhesives are not **SELECTED**, **APPLIED** and/or **REMOVED** properly

Who is at risk for MARS?



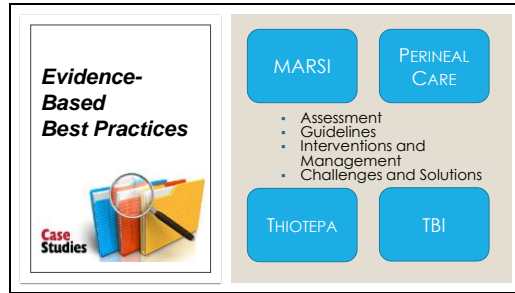
8%
of hospitalized
infants and children



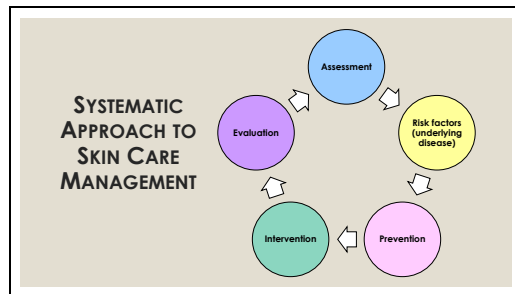
15.5%
of long-term
care patients

Medical Adhesives and Patient Safety: State of the Science Consensus Document

Slide 16




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MARSI CASE STUDY - DAVID

- 15mo old s/p autologous transplant for medulloblastoma
- Tolerated conditioning (Carbo, Etopo, Thiotepa) well with exception of persistent vomiting, now resolved.
- NG placed Day+14 to assist with medications and to initiate trophic feeds



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MARSI CASE STUDY - DAVID



- Feeding went well for 2 weeks until he accidentally pulled out NG tube
- NG replaced on opposite side without event and feeding resumed
- Securement device and tape securing original NG tube was then removed. Underlying skin found to be **erythematous, shiny, and denuded**.

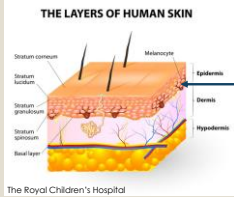
Slide 20

DEFINITION OF MARSI....

- **Medical Adhesive Related Skin Injuries**
 - A medical adhesive related **skin injury** is an occurrence in which erythema and/or other manifestation of **cutaneous** abnormality (including, but not limited to, vesicle, bulla, erosion, or tear) persists 30 minutes or more after removal of the adhesive -3M
- Damage to the skin that may occur when medical adhesives are not SELECTED, APPLIED and/or REMOVED properly

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MARSI INJURIES



THE LAYERS OF HUMAN SKIN

Stratum corneum
Stratum lucidum
Stratum granulosum
Stratum spinosum
Basal layer

Melanocyte

Epidermis
Dermis
Hypodermis

The Royal Children's Hospital

Skin Injury in MARSI

- Skin cell to adhesive attachment is stronger than the skin cell to skin cell attachment
- Separation or detachment of the layers of the epidermis or the epidermis from the dermis
- Injury can occur even without visual evidence in the setting of repeated application and removal of adhesives

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TYPES OF MARSI

- Skin tear
- Skin stripping
- Tension injury
- Maceration
- Folliculitis
- Allergic contact dermatitis
- Irritant contact dermatitis




Nichol et al. Medical Adhesives and Patient Safety: State of the Science Consensus Document - 2013.

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TYPES OF MARSI

- Skin tear
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Nichol et al. Medical Adhesives and Patient Safety: State of the Science Consensus Document - 2013.

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RISK FACTORS ASSOCIATED WITH MARSI

Extrinsic Factors

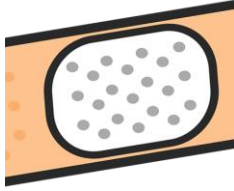
- Drying agents to the skin
- Prolonged moisture exposure
- Radiation therapy
- Medications:
 - Chemotherapeutic agents
 - Immunosuppressives
 - Anticoagulants
 - Prolonged corticosteroid use
- Photo-damage (e.g. UV-A/B)
- Mechanical issues
 - Shearing, pressure, adhesives




Intrinsic Factors

- Very young and elderly
- Dermatologic conditions
- Malnutrition
- Ethnicity??
- Underlying medical conditions
 - Infection, renal insufficiency, venous congestion, diabetes
- Dehydration


Slide 25

	<p>MARSI RISK-REDUCTION STRATEGIES</p> <ul style="list-style-type: none">• Best product for the clinical need• Application• Removal
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Slide 26

<p>CASE STUDY – “MARI”</p>	
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 <p><i>Who do you call for help?</i></p>	<p>CASE STUDY - “MARI” PERINEAL CARE CASE STUDY</p> <ul style="list-style-type: none">• 8mo old with AML CR2• Day +4 BMT for matched sibling marrow transplant• s/p Busulfan & Fludarabine• History of prolifc diarrhea during cyclic chemotherapy• Copious diarrhea for 2 days, now C diff+• Red, excoriated (denuded) perineal area under bum cream
---	---

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KEYS TO PERINEAL CARE

BUILDING BARRIERS



Cleanse the skin – gentle, alcohol free cleansing

Prevention - Apply **treatments and barriers** based on specific skin risk, concerns, and integrity

- Zinc oxide and/or petrolatum
- Cyanoacrylate: alone or in combo with zinc oxide/petrolatum

Treatment

- Apply medicated creams first, then barrier creams or cyanoacrylate.

Reassess, Evaluate & Modify

- Evaluate response after 48 hours, modify if necessary...

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"STANDARD" SKIN CARE - PREVENTION



CVC Care



Hygiene



Perineal Care

What is a healthcare bundle?

- A set of evidence-based practices that when consistently followed has been shown to lead to better outcomes.

<http://www.ihl.org/Topics/Bundles>

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HOW DO I SHARE SKIN CARE RECOMMENDATIONS WITH THE NURSING STAFF?


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PERINEAL CARE GUIDELINES FOR DIAPERED AND/OR INCONTINENT PATIENTS

Problem	Prevention	Assessment	Intervention	Documentation	Referral
Diaper rash	Change diaper every 2-4 hours. Cleanse with mild soap and water. Apply barrier cream.	Redness, irritation, itching.	Apply barrier cream. Use mild soap and water for cleansing.	Document location and extent of rash.	Refer to physician if rash persists or worsens.
Fungal infection	Keep area dry. Use antifungal powder.	Redness, itching, white discharge.	Apply antifungal powder. Cleanse with mild soap and water.	Document location and extent of infection.	Refer to physician if infection persists.
Bleeding	Use soft toilet paper. Avoid harsh soaps.	Redness, itching, bleeding.	Apply barrier cream. Use mild soap and water for cleansing.	Document location and extent of bleeding.	Refer to physician if bleeding persists.
Perianal abscess	Keep area clean and dry. Use warm compresses.	Redness, swelling, pain, pus.	Apply warm compresses. Cleanse with mild soap and water.	Document location and extent of abscess.	Refer to physician if abscess persists.

BCHO Skin Champions Committee – Perineal Care Recommendations - 2017


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CASE STUDY – “APRIL”

- 5 year old female diagnosed with AML in 2nd CR
- Treatment: PBMT/C study using a partially match family member after a negative selection of TCR alpha/beta depleted graft
- Conditioning regimen:
 - r-ATG 3 mg/kg X 3 doses
 - Busulfan 1 mg/kg X 10 doses
 - Thiotepa 5 mg/kg X 2 doses
 - Cyclophosphamide 60 mg/kg X 2 doses
 - Rituximab 375 mg/m² X 1 dose

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APRIL

- Tolerated conditioning well with exception of fever spike during r-ATG
- Skin care per APHON recommendations for Thiotepa infusions
- Bathe patient 3 - 4 times per day
 - Change linen with each bath
 - Avoid occlusive dressings, adhesive, lotions, and creams
 - Wear loose fitting clothing
 - if diapered, change diaper every 2 hours

Herring, R.A. (2019). 4th Edition: The Pediatric: Chemotherapy and Biotherapy Curriculum

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APRIL

- On Day +2, April began complaining of pruritus on her chest, back and upper arms
- On Day +3 she developed diffuse erythema on her trunk, upper arms and neck

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THIOTEPA

- Alkylating agent
- Metabolized in the liver
- Half life is 4.9 to 17 hours
 - Drug should be cleared within 48 hours
- Excreted through the skin and sweat glands
- Skin toxicity can include
 - Desquamation
 - Erythema
 - Hyperpigmentation
 - Pruritus




Roosman (2008) J American Academy of Dermatology

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APRIL

- Assessment of April's legs and buttocks appear clear
 - All places submerged in the bath water
- The diffuse erythema appears only above the water line



Schanderson & Baileys (2019) J Oncology Pharmacy Practice

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THIOTEPA SKIN CARE PRACTICES

- **How long do you follow Thiotepea skin care guidelines**
 - 24 hours after the last dose
 - 36 hours after the last dose
 - 48 hours after the last dose
- **How frequently do patients bathe?**
 - Every 8 hours
 - Every 6 hours
 - 3 - 4 times a day while awake
- **Do you allow soap?**
 - Mild soap
 - No soap
- **Central line dressing**
 - Occlusive dressings are removed during the infusion and for 24 - 48 hours post infusion
 - Occlusive dressings are allowed but must be changed 24 hours after the completion of the drug
 - There is no consensus on what to use to clean the site
- **Diapered patients**
 - Change hourly
 - Change every 2 hours
 - All agree no barrier creams

No clear standards in this country or Europe

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PRECAUTIONS TO PROTECT CAREGIVERS AND STAFF

Precautions aim to prevent exposure to Thiotepea excreted through the urine and/or skin

PARENT/CAREGIVER EDUCATION

Dear & Honored Transplant Family:

The Transplant Family is an important part of your child's care. We want to make sure you are comfortable and safe during your child's treatment. We will provide you with information about the precautions you need to take to protect yourself and your family from exposure to Thiotepea.

Thiotepea is a powerful medicine that is used to treat certain types of cancer. It is excreted in the urine and sweat. This means that there is a risk of exposure to Thiotepea if you are in contact with the urine or sweat of a child who is taking Thiotepea.

To protect yourself and your family, we recommend that you take the following precautions:

1. Wear gloves when changing your child's diaper or when cleaning up urine or sweat.
2. Wash your hands thoroughly with soap and water after you have changed your child's diaper or cleaned up urine or sweat.
3. Avoid contact with the urine or sweat of a child who is taking Thiotepea.
4. Avoid contact with the clothing or bedding of a child who is taking Thiotepea.

We also recommend that you avoid contact with the urine or sweat of a child who is taking Thiotepea for at least 24 hours after the last dose. This means that you should avoid contact with the child for at least 24 hours after the last dose.

If you have any questions or concerns, please contact your child's healthcare provider. We are here to help you and your family.


Thank you for your cooperation and support.

Wexler Children's Hospital

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TREATMENT

- Pruritus
 - Liberal use of fragrance-free lotions
 - Consider Hydroxyzine or Nalbuphne
- Desquamation
 - Keep area clean
 - Apply moisturizer
 - Apply barrier cream to perineal area
 - Topical steroids




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CASE STUDY – “NATHAN”

- 15 year old male diagnosed with ALL with CNS involvement, in CR2, and received a sibling matched related donor transplant
- Conditioning
 - FTBI (1200 cGy) given over 8 fractions on Day -7, -6, -5 and -4
 - Etoposide (60 mg/kg) given on Day -3
- Skin Care Instructions During Fractionated Total Body Irradiation (FTBI)
 - Daily baths with mild soap and water
 - Moisturize every evening with a hospital-provided lotion
 - Avoid deodorants/antiperspirants on the days of radiation
 - Wear loose fitting clothing
 - Avoid sun exposure

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NATHAN

- On Day +6 he developed erythema and desquamation to his neck and chest area
- In addition to the FTBI, he received a cranial spinal boost of 2400 cGy to his cranium, cervical spine and thoracolumbar spine

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Table 1: Grades of Cutaneous Radiation Injury

GRADE	SKIN LESIONS	PROGNOSTIC FACTORS	LETALITY	HARVEST SURVIVAL STAGE	TIME TO HEAL OR REPAIR	RECOVERY	LATE EFFECTS
1	1-2 dry macules	1-2 days No systemic manifestations	0-10% No death	1-2 weeks No systemic manifestations	1-2 weeks No death	Complete healing No late effects	Complete healing No late effects
2	3-10 dry macules No systemic manifestations	3-10 days No systemic manifestations	10-20% No death	2-4 weeks No systemic manifestations	2-4 weeks No death	Complete healing No late effects	Complete healing No late effects
3	10-30 dry macules No systemic manifestations	10-30 days No systemic manifestations	30-40% No death	4-6 weeks No systemic manifestations	4-6 weeks No death	Complete healing No late effects	Complete healing No late effects
4	30-50 dry macules No systemic manifestations	30-50 days No systemic manifestations	50-60% No death	6-8 weeks No systemic manifestations	6-8 weeks No death	Complete healing No late effects	Complete healing No late effects
5	50-70 dry macules No systemic manifestations	50-70 days No systemic manifestations	70-80% No death	8-10 weeks No systemic manifestations	8-10 weeks No death	Complete healing No late effects	Complete healing No late effects
6	70-90 dry macules No systemic manifestations	70-90 days No systemic manifestations	90-100% No death	10-12 weeks No systemic manifestations	10-12 weeks No death	Complete healing No late effects	Complete healing No late effects
7	90-100 dry macules No systemic manifestations	90-100 days No systemic manifestations	100% No death	12-14 weeks No systemic manifestations	12-14 weeks No death	Complete healing No late effects	Complete healing No late effects

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RECOMMENDATIONS FOR SKIN CARE FOR PATIENTS RECEIVING CRANIAL/SPINAL RADIATION

- Patients receiving a Cranial/Spinal Boost
 - Wash skin daily with mild soap and warm water
 - Avoid shaving
 - Apply fragrance-free moisturizer 1-3 times a day
 - Wear loose fitting clothing
 - Avoid putting any hot or cold on the treated skin
 - Protect skin from the sun
 - If skin starts to feel sunburnt, apply 100% pure Aloe Vera




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WHAT ARE THE KEY EDUCATION POINTS FOR LONG-TERM SKIN CARE AFTER TBI?

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**SKIN COMPLICATIONS:
LONG TERM CONSIDERATIONS**


- Key issues
 - Awareness and education
- Yearly skin exam and risk assessment for cutaneous cancer
- Importance of sun and skin protection
 - Hat
 - Sunscreen
 - Clothing
 - Sunglasses



Health, Cancer Research | Health, Cancer Research

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**TEST YOUR
KNOWLEDGE &
ASSESSMENT
SKILLS**



Are you a nurse detective?

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WHAT IS YOUR DIAGNOSIS?

- Chemotherapy Effects
- Radiation Effects
- MARS
- Drug Hypersensitivity
- Viral Infections



medicinesnaturally.com

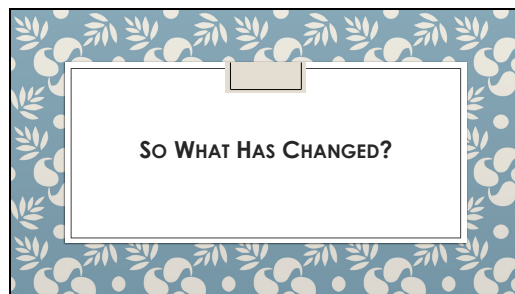
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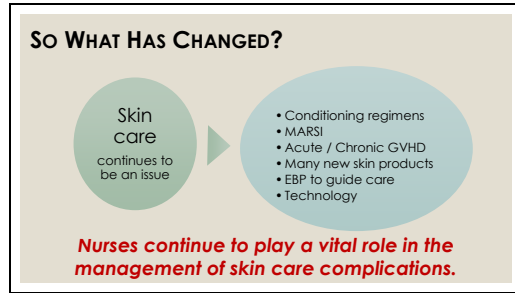
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Slide 54




Slide 55



Questions?
Feel Free to Contact Us
Linda, Nancy and Lisa



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SELECT REFERENCES

- Beedman D, et al. (2015.) Incontinence associated dermatitis: Moving prevention forward. Proceedings of the Global IAD Expert Panel. Wounds International 2015. www.ncbi.nlm.nih.gov/pmc/articles/PMC4581977/
- Even-Ori E, Kohn SA, Zuckerman L, Stepiensky P. (2019) Skin Toxicity following treosulfan-thiotepa-fluorouracil-based conditioning regimen in non-malignant pediatric patients undergoing hematopoietic stem cell transplantation. *Pediatric Transplantation*, Vol 24 (suppl 1)
- Hemall LH, Storey B, Steller LJ, & Finn Davis, K. (2017). Beginning at the bottom: Evidence based care for diaper dermatitis. *JACD* 10-16.
- Herring, R.A. (2019) 4th Edition The Pediatric Chemotherapy and Biotherapy Curriculum
- Lund, C. (2014). Medical adhesives in the NICU. *Neonatal & Infant Nursing Reviews* 14: 140-145.
- Nichols L, Lund C, Rosen T & Gray M (2013). Medical adhesives and patient safety: State of the science. *Orthopaedic Nursing* 27 (6): 247-261
- Nuss S (2011). Hematopoietic cell transplantation. In T Bogoff et al (eds). *Managing care of children and adolescents with cancer and blood disorders*. 4th ed. APHCH, B.
- Rosman, I et al. (2008). Cutaneous effects of thiotepa in pediatric patients receiving high dose chemotherapy with autologous stem cell transplantation. *Ann Acad Dermatol* 46: 575-578.
- Schneider J & Baubler (2019) Thiotepa induced cutaneous toxicity in pediatric patients: Case report and implementation of preventive care guidelines. *J of Oncology Pharmacy Practice* Vol 25(3) 489-493.
- UCSF Benioff Children's Hospital Oakland Skin Champions Committee (2017.) *Prevent skin care guidelines for diapered and/or incontinent patients*. UCSF Benioff Children's Hospital Oakland Nursing Patient Care Standards.
- Warford CD, Kohns JC, Pines JC, Candiani JD. (2016) Cutaneous graft-versus-host disease after hematopoietic stem cell – A review. *Ann Acad Dermatol* 54 (3): 336-343.
- Wu F.A., Cowen S. (2012). Cutaneous Graft-versus-Host Disease – Clinical considerations and management. In Hausmann P, Steiger J, Passweg J (eds): *Transplantation Dermatology*. *Curr Probl Dermatol* vol 43: 101-115.
- SM. A comprehensive guide to understanding and reducing the risk of MAGE. www.stanfordchildrens.org

