

# CHEMOTHERAPY IN PEDIATRIC ONCOLOGY

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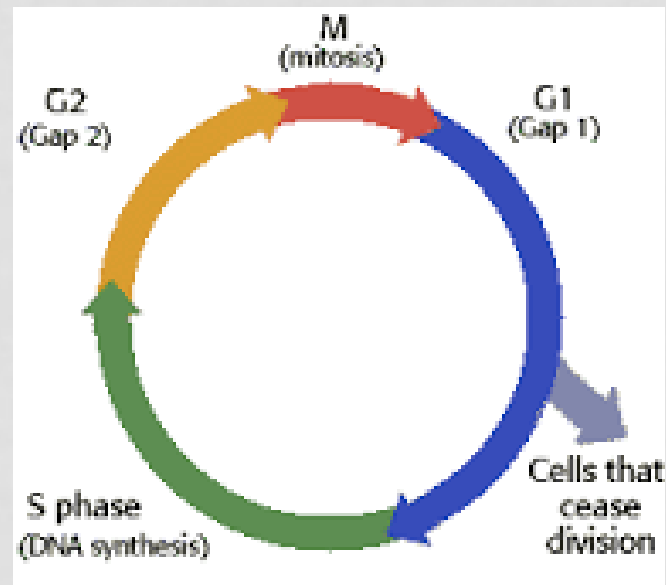


# OVERVIEW

- Principles of chemotherapy
- Chemotherapy safety
- Drug specific information
- Assessment of child receiving chemotherapy
- Extravasation
- Anaphylaxis

# PRINCIPLES OF CHEMOTHERAPY

- Chemotherapy = medications used to treat cancer by killing cancer cells
- Work by preventing the cancer cell from dividing/multiplying
- Can be either cell cycle specific or cell cycle non-specific



# CLASSIFICATION

## Cell Cycle Specific

- Act on cell division during one phase of cell cycle
- Work most effectively on rapidly dividing cells
- Examples:
  - Plant alkaloids (eg. Vincristine, Etoposide)
  - Antimetabolites (eg. Methotrexate, Cytarabine)

## Cell Cycle Non-specific

- Work during all phases of cell cycle
- Dose dependent: higher dose = more cells killed
- Examples:
  - Alkylating agents (eg. Cyclophosphamide, Cisplatin, Carboplatin)
  - Anti-tumor antibiotics (eg. Doxorubicin, Bleomycin, Dactinomycin)

**TO INCREASE NUMBERS OF CELLS KILLED BUT DECREASE AMOUNT OF SIDE EFFECTS, A COMBINATION OF DRUGS IS USED!**

# PRINCIPLES OF PEDIATRIC CHEMOTHERAPY

- Multimodal:
  - Use chemotherapy along with other treatments
- Combination:
  - Use more than one chemotherapy agent
- Adjuvant:
  - Using chemotherapy for tumors that have already been treated with surgery or radiation
- Neo-adjuvant:
  - Using chemotherapy **before surgery** to shrink tumor
- Sanctuary:
  - Give chemotherapy directly to areas of body where there are cancer cells (eg. into spinal fluid)

# CHEMOTHERAPY SAFETY: PREPARATION

Packaging	<ul style="list-style-type: none"><li><input type="checkbox"/> Chemotherapy should be packaged and labeled, sealed and in leak-proof containers.</li><li><input type="checkbox"/> Heat-sealed outer bags are preferable.</li></ul>
Drug Transport	<ul style="list-style-type: none"><li><input type="checkbox"/> Delivery should be directly to the units, with no detours</li><li><input type="checkbox"/> Should be delivered by trained staff</li><li><input type="checkbox"/> Containers used should be hard-walled and robust</li><li><input type="checkbox"/> If possible, containers should be disposable and lined with absorbent material</li><li><input type="checkbox"/> Spills should be handled according to policy</li></ul>
Labeling	<ul style="list-style-type: none"><li><input type="checkbox"/> Should be clearly labeled with "cytotoxic," appropriate light and temperature guidelines and expiration dates</li></ul>
Documentation	<ul style="list-style-type: none"><li><input type="checkbox"/> Transport should be properly documented, including transport and delivery times</li></ul>

# CHEMO SAFETY: PPE

Type of PPE	When to use	Comments
Gown	<ul style="list-style-type: none"> <li><input type="checkbox"/> Preparation</li> <li><input type="checkbox"/> Administration</li> <li><input type="checkbox"/> Disposal</li> <li>• Cleaning up spills</li> </ul>	<ul style="list-style-type: none"> <li>• Back and neck closures</li> <li>• Cuffs at wrists</li> <li>• Waterproof/non-porous</li> </ul>
Gloves	<ul style="list-style-type: none"> <li><input type="checkbox"/> Preparation</li> <li><input type="checkbox"/> Administration</li> <li><input type="checkbox"/> Disposal</li> <li>• Cleaning up spills</li> </ul>	<ul style="list-style-type: none"> <li>• Chemotherapy resistant</li> <li>• Latex, neoprene, or nitrile</li> <li>• May use double gloving if desired</li> <li>• Change gloves every 30 minutes or if contaminated</li> </ul>
Mask/Face Shield	<ul style="list-style-type: none"> <li><input type="checkbox"/> Preparation</li> <li><input type="checkbox"/> Administration</li> <li><input type="checkbox"/> Whenever a splash is possible</li> </ul>	
Goggles	<ul style="list-style-type: none"> <li><input type="checkbox"/> Whenever a splash is possible</li> <li><input type="checkbox"/> Cleaning up spills</li> </ul>	
Shoe Covering	<ul style="list-style-type: none"> <li><input type="checkbox"/> Preparation</li> <li><input type="checkbox"/> Cleaning up spills</li> </ul>	

# DISPOSAL OF CHEMOTHERAPY

- After infusion complete:
  - Remove all tubing/syringes and place in pharmacy bag. Seal bag and put into yellow bins
  - Any needles used should be placed in sharps container for chemotherapy/biotherapy products
- All unused chemotherapy should be returned to pharmacy for disposal.
- For 48 hours after chemotherapy:
  - Urine can be flushed in toilet; put lid of toilet down
  - Diapers placed in yellow bins



# CHEMO SPILLS

- Locate spill kit
- Contact the oncology team immediately.
- Report exposures through the hospital incident reporting process and injury report form.



Spill kit contains:

- PPEs: gloves, gown, shoe covers, goggles, mask (with filter)
- Biohazard bag
- Pads for cleaning up spill
- Powder to put on spill before cleaning up
- Sign: "Caution: Drug Spill"

# CHEMO CONTAMINATION

- Contact with cytotoxic agents:
  - Remove contaminated PPE/Clothing and wash skin with large amounts of soap and running water
  - Contact pharmacy if additional medication information is need
  - For eye exposure, immediately flood effected eye with running water for at least 5 minutes
  - Removed any contaminated clothing
- For **patients** who have direct contact with cytotoxic agent, wash skin with large amounts of soap and water,
  - Notify attending physician of patient's exposure

# CLEANING UP SPILLS

1. Limit the spread of the spill by covering with absorbent sheets or pillows or if a powder is involved, cover with one or more damp cloths or towels
2. Clean up the area of the spill immediately wearing gloves, gown, mask, goggles and shoe covers
3. Clean all contaminated surfaces **3 times** with surface-safe decontamination kit and wipe clean with water
  - Clean from least to most contaminated
4. Dispose of all contaminated materials and protective apparel in a yellow waste container
5. Contact housekeeper to perform regular cleaning of area

# SAFETY FOR CARETAKERS

- For 48 hours after chemotherapy:
  - Wear gloves when handling child's body fluids or diapers
  - Close the toilet lid when flushing urine
  - Dispose of diapers in yellow biohazard bins
  - If any of the child's urine, vomit or feces touches your skin, wash well with soap and water right away
- Mothers can continue to breastfeed
- There is **no risk** in being in the same room or touching the child after they have received chemotherapy

# PREVENTING CHEMO ERRORS

- Always check to ensure it is the correct:
  - Patient
  - Medication
  - Time
  - Route
  - Dose
- Check the chemo protocol and the order to make sure they match
- Always label syringes/bags with the drug, dose, and patient's name

# CALCULATING BSA

- Chemotherapy is dosed in  $m^2$ , based on body surface area
- Check the child's height, weight, and BSA to make sure the dose is correct

$$m^2 = \sqrt{\frac{\text{Height (cm)} \times \text{Weight (kg)}}{3600}}$$

# COMMON CHEMOTHERAPY MEDICATIONS

- Vincristine
- Dactinomycin
- Doxorubicin
- Carboplatin
- Etoposide

# VINCRIStINE

- Clear liquid given IV (slow push)
- Side effects:
  - Constipation
  - Jaw pain
  - Numbness/tingling (“pins and needles”) in fingers and toes; tripping over toes (foot drop)
  - Liver dysfunction (rare)
- Vesicant
  - If extravasation: Elevate and **warm** compress
- FATAL if given in spinal fluid



# DACTINOMYCIN

- Yellow/orange liquid given IV, slow push
- Side effects:
  - Nausea/vomiting (high potential)
  - Skin sensitivity to light
  - Skin color changes
  - Low blood counts
  - Diarrhea
  - Mouth sores
- Vesicant
  - If extravasation: elevate and **cool** compress
- Protect medicine from direct light

# DOXORUBICIN

- Red liquid given IV over 15-30 minutes
  - Urine also pink/red when excreted
- Side effects:
  - Nausea/vomiting (moderate potential)
  - Heart effects: arrhythmias, decreased cardiac muscle strength (cardiomyopathy)
  - Low blood counts (nadir 5-10 days)
  - Liver dysfunction (rare)
  - Rash (rare)
  - Allergic reaction/anaphylaxis (rare)
- Vesicant
  - If extravasation: elevate and **cool** compress
- Need to monitor total (cumulative) dose in lifetime: increased risk of cardiomyopathy over 300-400 mg/m<sup>2</sup>

# CARBOPLATIN

- Clear liquid, given IV infusion over 60 minutes (usually)
- Side effects:
  - Nausea/vomiting (moderate potential)
  - Low blood counts, especially platelets (nadir is 21 days)
  - Allergic reaction (risk increases with each administration)
    - If develop allergy: pre-medicate with Diphenhydramine, run at ½ rate
  - Electrolyte disturbance
  - Taste changes (metallic)
  - Hearing loss
  - Kidney toxicity
- Must not give if low platelets

# ETOPOSIDE

- Clear liquid, given IV over 60 minutes
- Side effects:
  - Nausea/vomiting
  - Low blood counts
  - Diarrhea (occasionally)
  - Hypotension, anaphylaxis (rare)
  - Rash
- To decrease hypotension:
  - Slower infusion (60-120 minutes)
  - Patient should not change position rapidly
- Concentration less than/equal to 0.4 mg/mL
- Can cause cracks in plastic tubing (check tubing)

# ASSESSMENT OF THE CHILD RECEIVING CHEMOTHERAPY

- Blood work
  - CBC/Hemogram: some medications require ANC >750, Platelets >75,000
  - Liver function, kidney function
  - Electrolytes
- GI:
  - Constipation, diarrhea, nausea/vomiting, weight and nutrition status, mucositis (mouth sores)
- Neuro:
  - Nerve pain, numbness, tingling, foot drop
- Skin:
  - Rashes, any open wounds, color (paleness, hyperpigmentation, jaundice)

# ASSESSMENT, CONT'D

- CV:
  - Blood pressure, heart palpitations, chest pain
  - Hydration status
- Respiratory:
  - Shortness of breath, cough, wheezing
- Hematological:
  - Bleeding: from gums, nose bleeds, cuts taking long time to stop bleeding
  - Easy bruising, petechiae

# ASSESSMENT: CASE STUDY

- 2 year old girl receiving chemotherapy for retinoblastoma (Vincristine, Carboplatin, Etoposide). What should you assess before starting her chemotherapy?
  - Height and weight, nutrition
  - Nerve pain, foot drop, numbness/tingling
  - Constipation or diarrhea
  - Bleeding or easy bruising
  - Blood work: CBC, electrolytes and liver/kidney function
  - Nausea/vomiting
  - Hydration status

# EXTRAVASATION

- Leakage of fluid out of a blood vessel into surrounding tissue
- Definitions:
  - **Vesicant:** fluid that can cause blistering, severe tissue injury, or necrosis
  - **Irritant:** fluid that causes aching, tightness, irritation of tissue but not usually necrosis
    - If left untreated or severe, can lead to necrosis





# VESICANTS & IRRITANTS

VESICANT	IRRITANT
Doxorubicin	Etoposide
Vincristine	Carboplatin (if >10 mg/ml)
Dactinomycin	

# PREVENTING EXTRAVASATION

- Always use a large, intact vessel with good blood flow
  - Forearm veins are usually good options
  - Avoid hands, feet, joints (eg. ACF)
  - Do not administer distal to a recent IV site
- Check for blood return every 2-5 ml (if push) or every 30-60 minutes (if infusion)
- Always stop infusion and assess site/blood return if:
  - Patient complains of pain
  - Concern that IV has moved out of place

# SYMPTOMS OF EXTRAVASATION

- Lack of blood return
- Swelling or leaking around site
- Site cool or hot to touch
- Redness, or skin can look “blanched” (pale)
- Burning, itching, discomfort or pain
- Blister, ulcer, or necrosis

# MANAGEMENT OF EXTRAVASATION

- **Stop** the infusion
- **Leave** the needle in place
- **Aspirate** as much fluid as possible
  - Do NOT flush the line
- **Pull** out needle
- **Elevate** the affected limb
- **Apply** dry compress
  - **Cool:** Cisplatin, carboplatin, dactinomycin, doxorubicin
  - **Warm:** Vincristine, etoposide
- **Notify MD**
  - Consider antidote (DMSO, Hyaluronidase for Vincristine/Etoposide)
  - Consider injection of 1:1 mixture of hydrocortisone and 1% lidocaine

# ANAPHYLAXIS

- Hypersensitivity reaction
- Can occur immediately or within minutes to hours after exposure (more serious reactions occur within minutes)
- Reaction can be localized or systemic
- Signs and symptoms:
  - Hives
  - Redness
  - Cough
  - Laryngospasm
  - Stridor, wheezing
  - Orbital/facial edema
  - Itchiness
  - Agitation
  - Anxiety
  - Light headedness
  - Shortness of breath

# GRADES OF ANAPHYLAXIS

GRADE	SYMPTOMS
I	Localized Hives <6 cm and occurring <6 hours from time of drug
II	Generalized reaction With hives
III	Systemic reaction Bronchospasm, chest tightness, cough, chills, shortness of breath, vomiting, tachycardia, cyanosis, agitation/restlessness
IV	Systemic reaction Any of above symptoms Shock Severe hypotension

# MANAGEMENT OF ANAPHYLAXIS

- **Stop** infusion
- **Assess** vital signs
- **Notify** MD
- **Administer** medications:
  - **Epinephrine** (1:1000) 0.01 cc/kg (maximum 0.5 cc) SC or IV
  - **Diphenhydramine** 1 mg/kg (maximum 50 mg) IV
  - If prolonged symptoms, consider steroid:
    - **Hydrocortisone** 2-4 mg/kg IV
  - If shortness of breath/bronchospasm:
    - **Albuterol** 1-2 puffs, can repeat if necessary
- Always monitor and maintain airway
- Maintain IV site- may need fluid bolus (10-20 cc/kg) if hypotension

# CASE STUDY: ANAPHYLAXIS

- A 4 year old girl with retinoblastoma is receiving her 4<sup>th</sup> cycle of chemotherapy. 30 minutes into her carboplatin infusion, she begins to complain of itchiness. You notice that her eyes and lips are slightly puffy.
- What do you do?
  - STOP THE INFUSION!
  - Assess airway, breathing, vital signs
  - Notify the doctor



# ANAPHYLAXIS CASE STUDY CONTINUED

- What medications would you anticipate administering?
  - Epinephrine 1:1000, 0.01 cc/kg SC or IV
  - Diphenhydramine 1 mg/kg IV
- What would you do for subsequent Carboplatin infusions?
  - Diphenhydramine prior to dose (if available)
  - Give over 2 hours
  - Have emergency medications available at the bedside, monitor closely during infusion

# REFERENCES

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