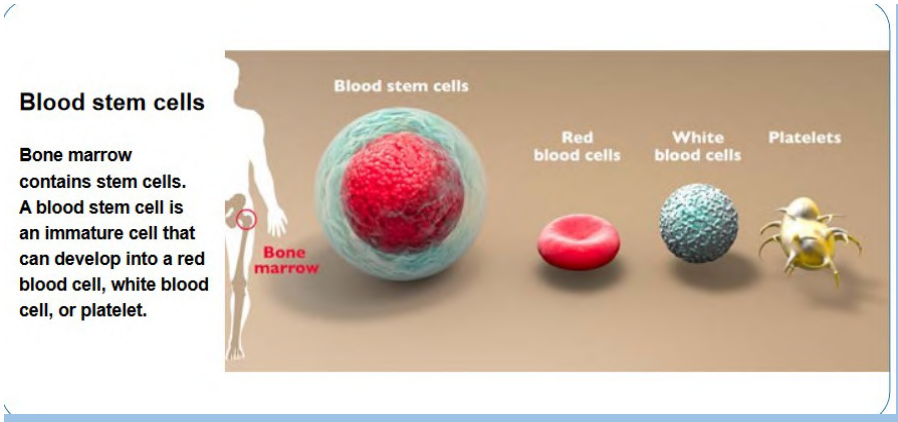
مؤسسة مستشفى سرطان الأطفال-مصر
Children's Cancer Hospital Foundation - Egypt
57357

Guidelines for Nursing Staff (Acute lymphoblastic leukemia)

2021- V1



Nursing Research Unit

مؤسسة مستشفى سرطان الأطفال-مصر
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Contents

1. Purpose

- Nursing Guidelines is to provide comprehensive, current, evidence-based nursing care for nursing staff who working with ALL patients.

2. Desired Outcome

- Reduce variations in nursing care and promote best practice.
- Develop an evidence-based nursing clinical practice guideline for nursing staff who are working with ALL patients.

3. Introduction

3.1. Childhood Leukemia

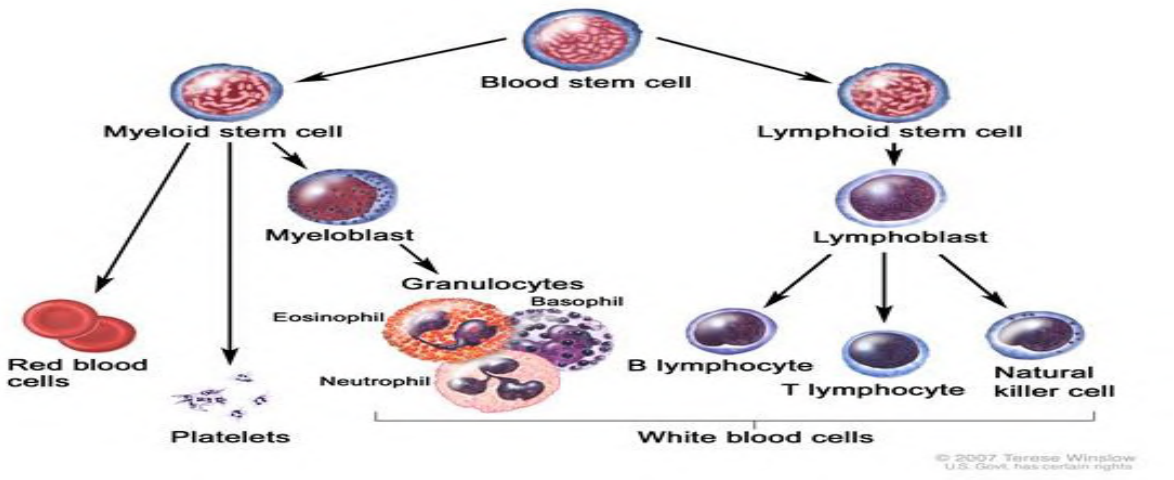
Leukemia is a cancer of the blood and bone marrow. It is the most common cancer in children and adolescents. Leukemia occurs when bone marrow does not work correctly. Bone marrow is the soft inner part of the bone. It functions like a blood cell factory. They begin as blood-forming cells (hematopoietic cells). If bone marrow works correctly, these blood forming cells become cells that eventually turn into red blood cells, white blood cells, and platelets. Major childhood leukemia subtypes include acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), and chronic myeloid leukemia (CML).

3.2. Acute Lymphoblastic Leukemia (All)

ALL is an uncontrolled proliferation of lymphoid cells in the bone marrow. It is the most common form of childhood cancer. ALL most often occurs in children ages 2 to 5y. It can also occur in older children and adolescents. ALL in infants is rare. ALL affects white blood cells called lymphocytes. These cells fight infection and help protect the body against disease. The most common treatment for ALL is chemotherapy. The World Health Organization (WHO) divides ALL into two subtypes: precursor B (B-lymphoblastic), the most common and precursor T-cell (T-lymphoblastic).

Blood cell development

Figure 1. Blood cell development. Different blood and immune cell lineages, including T- and B-lymphocytes, differentiate from a common blood stem cell.



3.2.1. Subtypes of ALL

- ***Precursor B-cell (B-lymphoblastic).***

B-cells play an essential role in humoral immunity of the adaptive immune system by secretion of antibodies. An antibody response is elicited against a specific antigen when unique B-cell receptors (BCR) expressed on the cell surface of B cells recognize and bind the antigen. In addition, B cells produce cytokines, present antigens, and function as regulators of the second branch of the immune system, innate immunity. All mature blood cells, including B cells, are generated by hematopoietic stem cells (HSC) and differentiate through the serial action of transcription factors (TF) that determine their cell fate at specific decision-making stages during development. Disturbances of B-cell development can cause diseases ranging from benign lympho-proliferation to malignant leukemia and lymphoma. Pre-B; Pro-B; C-ALL.

- ***Precursor T-cell (T-lymphoblastic).***

T cells play a central role in the adaptive immune response. T cells can be easily distinguished from other lymphocytes by the presence of a T-cell receptor (TCR) on their cell surface.

T cells are born from hematopoietic stem cells, found in the bone marrow. Then, developing T-cells migrate to the thymus gland to mature. T-cells derive their name from this organ where they develop (or mature). After migration to the thymus, the precursor cells mature into several distinct types of T cells. T cell differentiation also continues after they have left the thymus. Groups of specific, differentiated T cell subtypes have a variety of important functions in controlling and shaping the immune response.

4.Diagnosis of Leukemia

- ***History:***

It is important to assess biographic and demographic data such as name, date of birth, age, parents & sibling's information, etc. and assess past medical history as allergies, past illness, surgeries, birth history……etc.

- ***Physical Examination:***
  - ✓ keep the patient privacy.
  - ✓ ***Before beginning the assessment:*** Wash hands, explain the procedure and prepare the needed equipment.

- ***Assessment***

✓ Start initial assessment (airway, breathing, circulation), then assess patients from head to toe.
✓ Assess head and neck for any deformity, hair loss, involuntary movement.
✓ Examine the eyes for diplopia, abnormal conjunctiva, abnormal fundi, abnormal pupils or deviation of eye.
✓ Examine the nose for any redness, welling or drainage.
✓ Examine the mouth and throat for any symptoms as choking, difficulty swallowing, halitosis, hoarse voice, sore throat, tonsillar enlargement, loose teeth, malocclusion of teeth, bleeding from gum, discoloration or swelling ulceration.
✓ Examine the ears for discharge, redness or found cochlear implant.
✓ Assess cardiovascular system for symptoms as pink or pale nail color, examine capillary refill.
✓ Assess respiratory system for symptoms as difficulty breathing at rest or with activity, orthopnea-shallow- grunting. Assess neurological system for symptoms as confusion-drowsiness, hallucinations, gait (jerky –asymmetrical) clonus (present –not present).
✓ Assess gastrointestinal system for symptoms as diarrhea-vomiting- cramping, abdomen description (flat-distended-symmetric), abdomen palpation (firm-mass rigid), emesis (clear –bloody).
✓ Assess genitourinary system for symptoms as hematuria-oliguria –polyuria, dysuria, bladder distention, color and odor.
✓ Assess integumentary system for any signs and symptoms as bleeding, bruising, and tiny purple or red spots on patients' skin. These signs can occur because the level of platelets in the blood has dropped or signs and symptoms as pallor, also signs and symptoms as fever or focus infection.

- ***Laboratory Studies***

✓ Complete blood count with manual differential.
✓ Bone marrow aspiration (and/or bone marrow biopsy).
✓ Lumbar puncture to determine the possibility of dissemination of leukemia into the cerebral spinal fluid (CSF). Flow cytometry is used to determine the immune-phenotype of the lymphoblastic cells for accurate diagnosis and treatment planning.
✓ Cytogenetic testing is also performed on the leukemic cells acquired chromosomal abnormalities.
✓ Molecular testing.

5.Acute Lymphoblastic Leukemia Treatment Protocols (Dosing & Risk Stratification).

Most of the patients with ALL are treated as per Total XV protocol, whereas patients aged <1 year at presentation are treated as per Infantile ALL protocol.

5.1 Total XV

Patients are classified into four categories (very low, low, standard, or high-risk) based on the presenting age, leukocyte count, immune-phenotype, cytogenetic and molecular diagnosis, DNA index, presence or absence of CNS involvement or testicular leukemia, and early response to therapy.

Chemotherapy doses are based on BSA (m^2 dosing) except for Vincristine (VCR). In patients below 10 Kg, Kg-dosing is used.

Acute Lymphoblastic Leukemia Risk Stratification.

Acute Lymphoblastic Leukemia Risk Stratification [1]

Very Low	Low	Standard	High
B-Cell with precursor ALL with: • **Age: 1 year - < 10 years & TLC: < 50 x 10^3/L** • DNA Index: ≥ 1.16 OR t(12:21) • CNS I **OR** CNS II[3] • MRD d 15 < 0.01 % and MRD end of induction < 0.01 % **Without unfavorable Features** [2]	**B-Cell with precursor ALL with:** • Age ≥ 10 **OR** TLC > 50 x 10^3/L with DNA Index: ≥ 1.16 (Hyperdiploidy) OR t(12:21) • **OR** Age: 1 year - < 10 years & TLC: < 50 x 10^3/L **with** • CNS I **OR** CNS II[3] • MRD d 15 < 1 % and MRD end of induction < 0.01 % **Without unfavorable Features**[2]	**1- All T-Cell of ALL** **2- B-Cell with precursor ALL with:** • Age ≥ 10 years • **OR** TLC > 50 x 10^3/L • **OR** CNS III[3] • **OR** Overt testicular leukemia by U/S • **OR** Adverse genetic features: ➢ t(1:19) ➢ MLL gene Rearrangement on (11q23) ➢ t(9:22) with MRD < 0.01 % by flow cytometry at end of induction and MRD by PCR > 4 log reduction on W 7 • **OR** poor Early response ➢ MRD > 1 % at day 15 ➢ MRD (≥ 0.01% but < 1%) at end of induction	• t(9:22) with MRD > 0.01 % by flow cytometry at end of induction or MRD by PCR < 4 log reduction on W7 • **OR** t(17;19)[4] • **OR** Intra-Chromosomal Amplification of chromosome 21 (iAMP21)[5] • **OR** Hypodiploidy (< 44 Chromosome) • **OR** Induction failure • **OR** B-Precursor ALL patients with end of induction MRD ≥ 1% • **OR** T-cell ALL patient with MRD ≥ 0.1% after early intensification • **OR** Any ALL patient with positive MRD at end of consolidation • **OR** Rising MRD after remission induction

BMT Criteria	
• T-cell ALL patients with induction failure (BM or MRD ≥5%) • T-cell ALL patient with MRD ≥ 0.1% after early intensification • B-Precursor ALL patients with end of induction MRD ≥ 1% • Any ALL patient with positive MRD at end of consolidation • Re-emergence of leukemic lymphoblasts by MRD ≥ 0.01% in patients previously MRD negative	• iAMP21 with MRD ≥ 0.01% at end of induction • Hypodiploidy B-Precursor ALL patients with end of induction MRD ≥ 0.01% • Philadelphia ALL patients with MRD end of induction ≥ 0.01% by flow or molecular MRD at W7 < 4 log reduction • Patients having t(17,19) • Rising MRD after remission induction

[1] See Total XVI's Intrathecal table
[2] **Unfavorable Features:**
- Overt testicular leukemia by U/S
- CNS III [3]
- Adverse genetic features

[3] Traumatic CSF (≥ 10 RBC/L of CSF), CNS-2 Status (< 5 WBC/L of CSF with blast), CNS-3 Status (≥ 5 WBC/L of CSF with blast or cranial nerve palsy).
[4] This Translocation is associated with Initial hypercalcemia.
[5] (iAMP21) define as: Three or more extra copies of RUNX1 on a single chromosome 21 by cytogenetic report (≥ five total RUNX1 signals).

5.2 Infantile ALL protocol

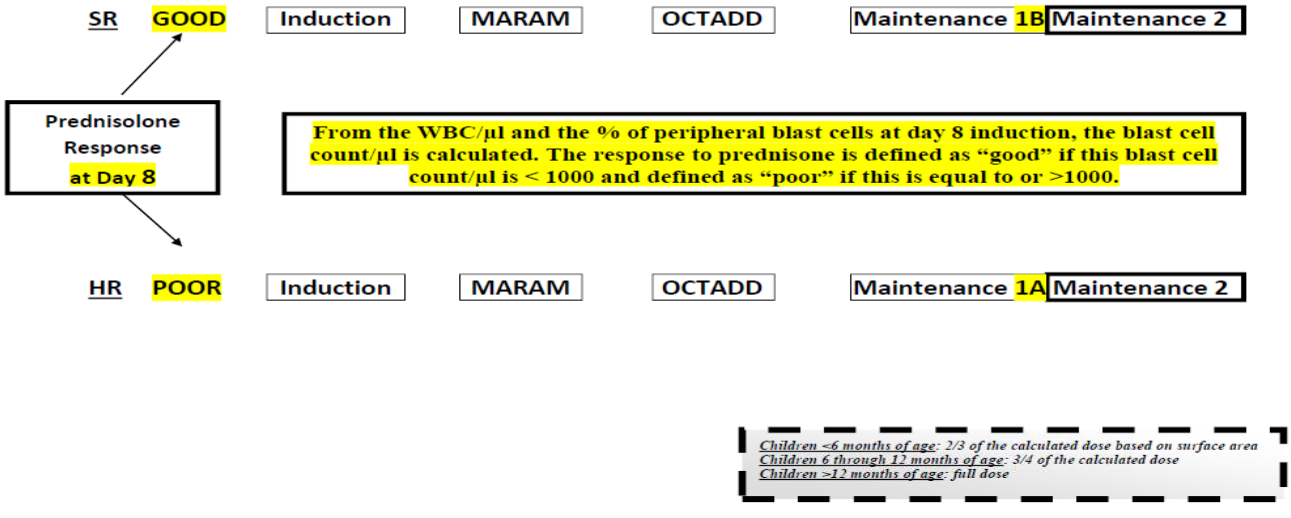
Infantile Leukemia is defined as onset of disease at less than one year of age. Associated with 11q23 abnormalities; t (4;11) is the most common and results in a Pro-B cell phenotype

ALL-infantile protocol applies the most comprehensive risk classification to the patients, combining blast cell immune-phenotype and genotype, with presenting clinical features and early treatment response. Accordingly, cases are divided into 2 risk groups: (A, B) [according to Induction good responders (B), Induction poor responders (A)]. Phases of treatment are divided, as contemporary protocols, into 4 phases: Induction Phase (35 days), MARAM (23 days), OCTAAD (48days), maintenance 1 (A or B), Maintenance 2.

Chemotherapy doses are based on BSA (m ^{2} dosing); however, dose reductions are applied according to patient age. Patients below 6 months receive 2/3 of the calculated dose, patients aged 6 months through 12 months receive ¾ of the calculated dose whereas patients above 1 year (12 months) receive full dose.

Infantile ALL protocol.

INTERFANT 99	CCHE-infALL#1-1-2012	Patient Name:	
	Version 2 dated _2-9-2012	MRN:	



6.Patients Response

The doctor checks how many leukemic cells are left inside the child's blood and bone marrow. Minimal Residual Disease (MRD) is a term used when there are so few leukemia cells in the bone marrow that they cannot be found using a microscope. Highly sensitive tests such as flow cytometry, polymerase chain reaction (PCR), and next generation sequencing can detect leukemia cell in 10,000-1,000,000 normal cells in the bone marrow.

Children who have positive MRD (more than 1 cell in 10,000) after induction therapy are at the greatest risk of relapsing.

Patients' response is assessed on day 15 Ind. & at end of induction. Patients with high MRD on day 15 might require repeating MRD measurements on day 22.

7.Role of Pediatric Oncology Nurse

Nurses are important members of a patient's care team. For children being treated for cancer, nurses perform a number of critical functions. Nurses often serve as a patient and family's first line of contact in and out of the hospital. Nurses lead the caring process and tend to patients' daily needs as checking vital signs, feeding the patient, preparing patients for treatment or surgery, administering chemotherapy and other medicine, performing assessments and physical exams, drawing blood or other fluids for laboratory tests, administering blood products as part of a transfusion or to replace lost blood and providing hygiene care. Before, during and after any procedure or medication administration nurses should check the physician order and review treatment plan with the physician. Confirm that patient has signed informed consent, ensure patient identification, explain procedure to the patient and family, Wash hands & provide privacy Check medication with unit clinical pharmacist from physician order and on the E-MAR, verify the medication labeled correctly is the right medication, dose, route, time, patient name, medical number, expired date (beyond use date) & volume and secure intravenous cannula for medication administration.

Nurse also communicates with the health care team if there are any changes in the patient's assessment or laboratory values. Due to the high acuity of these patients, any small changes in the nursing assessment or laboratory findings can be indicative of a larger problem. **Proper documentation** of all nursing assessments, inputs and outputs, & vital signs is also an essential form of communication with others on the health care team. Nurses play a vital role in preventing, recognizing, and treating pediatric oncology emergencies, which can happen at diagnosis, as a complication of therapy, or at disease progression or recurrence. Nurses play a critical role in

educating families, as information about cancer diagnosis, medication and treatment and also care at home, instruct patient to avoid receiving live vaccines during treatment.

Instructions for safe handling and disposal of the medicine and avoid contact with patient body fluids, which can contain the drug for 48 hours after it is given (this precaution applies to different chemotherapy).

8.Treatment of Acute Lymphoblastic Leukemia

Treatment for ALL includes chemotherapy. In general, treatment on Total XV lasts for 3 years whereas the infantile protocol lasts for 2 years (104 weeks). Chemotherapy treatment for ALL consists of several phases with specific goals: induction (to induce remission), consolidation/CNS-directed therapy (to strengthen remission), and maintenance or continuation therapy for residual disease. A subgroup of patients additionally receives re-intensification course(s).

8.1. Induction therapy (Remission Induction from 6 to 7 weeks)

Induction designed to provoke remission, is calculated using the child's age, immune-phenotyping and WBC risk-group assignment to either standard or high-risk therapy. The remission-induction phase normally includes intrathecal therapy and three or four chemotherapy drugs: prednisone, vincristine, asparaginase, and anthracyclines (doxorubicin). The second phase of induction includes cyclophosphamide, cytarabine, 6-MP and Triple Intrathecal administration (a combination of methotrexate, cytarabine, and hydrocortisone). Intrathecal is designed to eliminate or prevent leukemic cells in the CNS, which can be a sanctuary for leukemic cells due to the blood brain barrier. Philadelphia positive patients start Tyrosine kinase inhibitors (TKI) imatinib or Dasatinib as order.

8.2. Consolidation therapy (8 weeks).

Children who achieve remission following induction therapy move to consolidation therapy with the goal of destroying any remaining cells that could begin to grow and cause the leukemia to relapse. The consolidation phase generally includes oral daily 6-MP (mercaptopurine) and intravenous MTX (methotrexate) and intrathecal therapy.

8.3. Re-intensification Treatment (for High-Risk ALL).

Some patients with high-risk criteria will receive one or two intensification course(s) after consolidation phase.

8.4. Continuation (120 weeks for girls and 146 weeks for boys).

The goal of Continuation therapy is to destroy any cancer cells that might have survived the first 2 phases. Maintenance may last 2 to 3 years. Combination of IT MHA (methotrexate + hydrocortisone + cytarabine), dexamethasone, 6-mercaptopurine, doxorubicin vincristine, l-asparaginase, methotrexate, cytarabine and cyclophosphamide.

Re-induction treatment will be given twice: weeks 7 to 9 and weeks 17 to 19 for all patients. All patients must also have ANC ≥ 500/mm3, WBC ≥ 1000/mm3, and platelet count ≥ 50 x 109/L before the start of re-induction treatment.

Evaluation in Total XV protocol should be done on D15 induction phase, D42 end of induction phase, post consolidation phase for stander risk (SR)and high risk (HR)patients, on week7 maintenance phase, on week 48 maintenance phase and on end of treatment.

9.Chemotherapy and Administration Notes (Table 1)

Note:

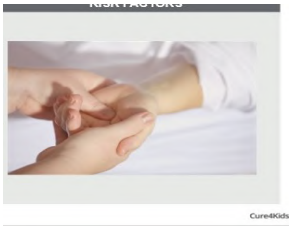
- ✓ **Any medical side effects should be reported to the doctor.**
- ✓ **Any medication should be given as doctor recommendations.**

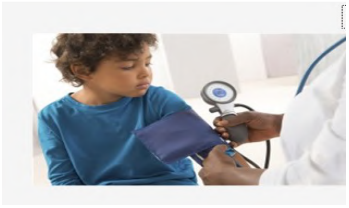
Medication	Precaution	Common side effects	Nursing intervention
Induction Therapy Phase To reduce the leukemic burden by 99% and restore normal hematopoiesis.			Important to note risk of **tumor lysis syndrome** during this phase of treatment due to rapid lysis of cellular tumor burden. **Nursing actions** include ensuring adequate hydration, and management of prescribed uric acid-lowering agents.
-Allopurinol (Zyloric, tab.)	-Store at room temperature at dry place. -Protect from light.	-Upset stomach (a gastritis, nausea, vomiting). -Acid production.	-Maintain adequate hydration as doctor order. -Drink plenty of fluids as doctor order. -Monitor intake and output as doctor order. -Take allopurinol with a meal or right after a meal to reduce nausea and vomiting as doctor order.
-Mucogel (syrup).	-Store at room temperature	-Constipation ,nausea, vomiting.	-Separated than other medication for 2 hrs as doctor order. -Check the bottle before administer.
Sevelamer (Renagel) Oral	-Store at controlled room temperature -Protect from moisture -Administer with meals, at least 1 hour	-Abdominal pain, anorexia, bowel obstruction, constipation, diarrhea, dyspepsia, fecal impaction, flatulence, nausea,	-Monitor serum levels of phosphate, Ca, Cl and bicarbonate as doctor order. -Vitamin supplementation as doctor order due to reduction in vitamin D, E, K and folic acid absorption.

	before or 3 hours after other medications. -Swallow tablets whole; do not chew or crush Because the contents will expand with water.	vomiting	-Monitor for signs and symptoms of peritonitis in patients undergoing peritoneal dialysis and report to the doctor. -Assess any abnormality as black and tarry stool or red blood in stools and report to the doctor.
-Hydration	-Patients during initial phase receive hyper hydration inform of 3000 mm^3 as a part of management of tumor lysis syndrome and this amount may be reducing in specific indication like mediastinal mass.	----	-Monitor fluid balance **(Not positive)** -Assess chemistry (lysis) potassium, uric acid, phosphorus, calcium and creatinine and report to the doctor. -Monitor daily weigh for infants <1 years and report to the doctor.
-Diuretics	-Store at room temperature		-Monitor patient weight before gives the medication and report to the doctor. -Check potassium level and notify the doctor. -Monitor intake and output and report to the doctor. -Monitor patient blood pressure and report to the doctor if any abnormalities according to schedule of vital signs. Please click on the link below: http://10.250.1.6/pp/08-57357-NURSING%20DEPARTMENT/02-NURSING%20POLICIES/01-GENERAL%20POLICIES/PP-NUR-021-Attachment%20-%20Vital%20Signs%20Monitoring.pdf

-Prednisone Intensol, Prednisolone (tab, syrup) Oral/q8hr. In case of any problem as (vomiting – abdominal pain) ***shift to*** **Methylprednisolone** IV / q8hr as doctor order **<u>NB: In interfant protocols</u>** Dexamethasone orally or intravenously as bolus injection in 3 divided doses	-Stored at room temperature	-Water retention (can cause increased blood pressure). -Peptic ulcer. -Heartburn 4- Hyperphagia (Appetite Stimulation/Food Consumption and Weight Gain. 6-Increased Blood Sugar Levels	-Monitor blood pressure for any signs and symptom of increased blood pressure and report to the doctor. - Assess any signs of infection, or visual changes and report to the doctor. -Assess fluid balance (intake and output) and report to the doctor. -Administer oral prednisone with meals and PPI (pantoprazole, esomeprazole) as order. -Monitor glucose levels closely in patients with diabetes and as doctor order -Monitor weight and report excessive gains/losses; To the doctor. -Diet with low-sodium, low sugar, high-protein diet. - Check urine and blood tests and report to the doctor. -**T**each patient to recognize signs/symptoms of hyperglycemia as (increased urinary frequency (Polyuria), thirst (polydipsia), hunger (Polyphagia) and to report these signs/symptoms to the doctor. -Instruct patient to report evidence of gastric distress immediately.
-Triple ITH: **(MTX + Hydrocortisone**	--Patient fasting preparations before ITH. --Platelet count at	-Nausea -Vomiting	-Review CBC and platelet count before ITH. If the patient is significantly thrombocytopenia, a platelet infusion may be indicated before the procedure as

+Ara- C) ***NB:*** In interfant protocols; double Ith is administered during induction ***Ith*** dose is age-dependent	initial ITH ≈ 50,000 mm^3 to avoid traumatic lumber puncture. -Check any blood culture for patient	-Fatigue -Temporary Headaches -Dizziness, Blurred Vision, Loss of Balance	doctor order. -Ensure the patient lies flat for 15 -30 minutes after the procedure to maximize distribution of the drug and minimize the risk of a spinal headache. -Check vital signs after ITH as hospital policy see above. -Assess the lumbar puncture site for infection, hemorrhage, bruising at the site, backache. -Monitor Intake /Output and report to the doctor. -Give the doses of Ca Leucovorin (folinic acid) as doctor order at 24 and 30 hours after methotrexate to provide an alternative source of folic acid, particularly to the gastrointestinal tract and bone marrow. -Cutoff for *first Ith, platelet > 50,0000; cutoff for the rest of Iths is PLT> 20000* -Anesthesia should be avoided in case of patients with hyper leukocytosis. -**P**atients should stop **Low Molecular Weight Heparins** (LMWH) 24 hr before Ith and resumed 24 hrs after.
Vincristine sulfate (Oncovin, VCR)	-Stored under refrigeration. -Protected from light. **-IV only.**	-Peripheral Neuropathy (loss of motor or sensory nerve function due to injury, inflammation, or degeneration of peripheral	-Assess neurologic status, including motor and sensory function and reflexes. -Assess any changes in the patient's gait (foot drop) handwriting, and grip strength and report any change to the doctor.

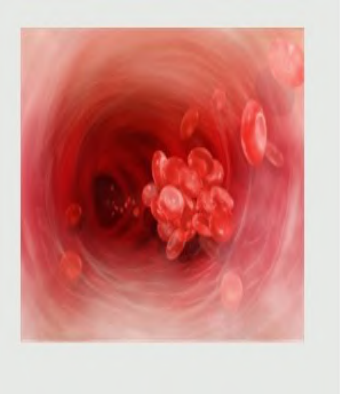
	-Assess cannula site and determining adequate blood return before, during and following administration of vincristine is essential. -Maximum dose (2 mg). Kg dosing for patients below 10 kg No surface area. -Vincristine is modified in case of hepatic dysfunction and severe neuropathy. -Total XV modification based on bilirubin as follows -Direct bilirubin 2-4 mg/dl 50% dosage decrease. -Direct bilirubin 4-6 mg/dl 75% dosage decrease. -Direct bilirubin >6 mg/dl withhold dose.	nerve fibers. -Neurotoxicity  -Jaw Pain. -Paralytic Illus.	-Administer analgesia if needed as order. -Patients may require as order for physical therapy or occupational therapy if the nerve damage has caused changes in walking, strength, or other motor functions as doctor order. -Protect patient from falls and injury. -Assess for pain or paresthesia (numbness, tingling, pain), loss of deep tendon reflexes, weakness (wrist drop or foot drop, gait disturbances), ptosis cranial nerve palsies (jaw pain, hoarseness, visual changes), autonomic dysfunction (ileus, difficulty voiding, orthostatic hypotension, impaired sweating) and report to the doctor. -CNS dysfunction (decreased level of consciousness, agitation, hallucinations). Notify physician if these symptoms develop, as they may persist for months. -Infants may have difficulty sucking because of jaw pain and assess degree of pain and report to the doctor. - Intrathecal administration of vincristine can be fatal or result in severe neurological damage. The drug should not be available in the same room when lumbar puncture is being performed. -Azoles i.e. fluconazole and voriconazole interact with vcr; they should be withheld 24 hrs before and resumed 24 hrs after

		- Extravasation.	vincristine. - Monitor CBC with differential as doctor order. -Monitor infusion site closely to prevent extravasation. - Drug is a vesicant and may cause tissue damage and necrosis. -If extravasation occurs, **apply hot pack** as order and follow Prevention and Treatment of Drug Extravasation policy at 57357. Please click on the link below: http://10.250.1.6/pp/08-57357-NURSING%20DEPARTMENT/02-NURSING%20POLICIES/01-GENERAL%20POLICIES/PP-NUR-022-Prevention%20%20Treatment%20of%20Drug%20Extravasation.pdf
DOXORUBICIN (Adriamycin)	-Protect from light. **Total XV modifications:** -Dosages should be modified in patients with elevated direct bilirubin concentrations or other evidence of biliary obstruction ➔if --direct bilirubin 2-4	-Cardiotoxicity. 	-Check that baseline ECHO is done. - Regular monitoring of ECG and echocardiograms as doctor order. -Monitor the cumulative dose of DOX received as protocols. -Assess patients for changes in heart rate or rhythm, changes in activity tolerance, and increased or decreased blood pressure from their baseline and report to

	mg/dl 50% dosage decrease. --direct bilirubin 4-6 mg/dl 75% dosage decrease. --direct bilirubin >6 mg/dl withhold dose. - The first dose of doxorubicin may be delayed in patients with evidence of mucositis or increased hyperbilirubinemia (i.e., total bilirubin ≥2.0 mg/dl and direct bilirubin >1.4 mg/dl). Omit this dose of daunorubicin if total bilirubin is still >2 mg/dl and direct bilirubin >1.4 mg/dl on day 12. A dose of daunorubicin may be given as soon as hyperbilirubinemia has resolved. -Patients with mucositis or active infection should be evaluated for herpes simplex	-Extravasation -Neutropenia	the doctor. -Manage hypotension with IV fluids and blood product transfusions as indicated as order doctor. -Monitor fluid balance (intake and output) and report to the doctor. -Collect serum electrolytes as ordered and monitor for abnormalities. (in case of changes in rhythm) and report to the doctor. - Monitor IV site closely for redness, loss of blood return, or swelling and report to the doctor. -Severe tissue damage and necrosis can occur upon extravasation. -Extravasation kit must be available in the unit. -If extravasation occurs, **apply cold pack** as order and follow Prevention and Treatment of Drug Extravasation policy at 57357 see above **table 1.** - Assess clinical condition of the patient before give doxorubicin drug in induction phase -Assess for any focus of infection and

	infection and treated with medication as order if work-up is positive.	-Red discoloration of the urine and other body fluids.	report to the doctor. -If patients develop neutropenia manifested by fever and infection follow the guideline in the **table 3.** -Ask mother to change dipper every one hour if child is incontinent and wear gloves during diaper change. -Observe redness urine and report to the doctor. -Monitor intake and output ratios, and report occurrence of significant discrepancies. -**I**nstruct patient to inspect oral mucosa for erythema and ulceration. The risk of developing stomatitis is most significant 5– 10 days after a dose; the usual duration is 3– 7 days. -Instruct patient that urine will be red tinged after receiving drug.
L-ASPARAGINASE **(IV or IM)**	***For IV injection.*** -**Do not** shake or squeeze the bag -**Do not** infuse other intravenous drugs through the same intravenous line while infusing E-coli *asparaginase*. -Insert cannula - Measure random	- Pancreatitis.	-Monitor for signs and symptoms as abdominal pain, nausea, vomiting, elevated serum amylase during therapy. -Promote oxygenation as order. -Provide adequate pain control as doctor order. -NPO / TPN as order. - Monitoring intake and output and report to the doctor.

	blood sugar before administration -Ensure emergency kits (Avail, Epinephrine - Solu-Cortef) are present to use in case of hypersensitivity reaction (urticarial, diaphoresis, facial swelling, joint pain, hypotension, bronchospasm). -Check cannula site every 15 minutes and sign and symptom of reaction, and give from 1 hr to 2 hr. -Patient on monitor and beside patient mask oxygen. -Given on morning shift ***For IM injection.*** -Put Ezanal cream on site of injection at least 30 minutes before administration in case of IM injection. -Give every syringe in separately. -Give L-Aspara after 3 hours from ITH.	- Hyperglycemia. -CNS thrombosis or hemorrhage. -Pediatric Stroke Cerebrovascular accident (CVA) Anaphylaxis (is an immediate or delayed systemic reaction to a foreign protein (antigen).	-Monitor blood glucose before and periodically during therapy. -Assess nutrition status and report to the doctor. -Assess any signs as headache, convulsion or loss of consciousness. -Give the patient Immediate medication as order to reduce propagation/ extension of the thrombus. -Assess any signs as altered field of vision and visual perception, aphasia (difficulty with speech and language), dysphagia (trouble swallowing) or seizures and report to the doctor. -Respiratory &nutritional support as doctor order -Reposition and recheck the patients as doctor order -Give patient medication as order. -Assess accurate history of allergies and past reactions (for patients with previous L-Aspara allergy; the. Length of infusion is to be prolonged) -Assess any signs and symptoms as nausea, vomiting, difficulty of breathing, hypotension, tachycardia, collapse due to a sudden drop in blood pressure, flushed

	-Monitor patient site after (IM) administration for at least one hour after an injection of asparaginase to check for any allergic reaction.		appearance, urticaria, rash, pruritus, confusion, dizziness or listlessness and notify the doctor.
CYCLOPHOSPHAMIDE (Cytoxan)	-Stable for 24 hours at room temperature and 6 days if refrigerated	-Hemorrhagic cystitis (is an inflammation of the bladder lining that causes bleeding, clot formation, and painful urination (known as dysuria). 	-Administer premedication as ordered. -Forced fluid IV and Mesna should be administered as close to on time as possible to decreases the incidence and severity of hemorrhagic cystitis. --Measure intake and output and report to the doctor. --Encourage child to go to bathroom and ask mother to observe any changes in urine color. --Provide adequate daily fluid intake to avoid hemorrhagic cystitis **if** kidney or heart problems as order --Report urinary symptoms immediately to doctor These symptoms include (Blood in the urine pink or red urine, Frequent urination or urge to urinate, Trouble urinating, Incomplete emptying of bladder, Pain during urination). --Check ordered labs as order and report any abnormalities. -Assess platelet and hemoglobin for fever

			-Assess WBC for infection. -Urinalysis is also a recommendation to evaluate for the presence of hematuria, proteinuria, or bacterial infections. -Monitor for hepatic toxicity (Cyclophosphamide is metabolized in liver, since liver may not be able to metabolize drug. -Monitor for decreased kidney functioning. (Cyclophosphamide is excreted through kidneys.) - Closely monitor infusion site for extravasation. -Extravasation kit must be available in the unit. -If extravasation occurs, follow Prevention and Treatment of Drug Extravasation policy at 57357 see above. -Encourage patient to urinate before going to bed for the night to empty the bladder.
Cytarabine (Ara-C) (Cytosar)	-Stored at room temperature.	-liver dysfunction. -Conjunctivitis with HD	- Administer pre-medications as ordered -Assess AST, ALT, and bilirubin -Mouth care every 2 hr as order. - Assess sign and symptom of skin rash and report to the doctor. -Assess any CNS toxicity (confusion, mood changes, numbness, tingling, severe muscle weakness, or stiff neck) and report to the doctor.

		-Flu like syndrome (Fever). -Thrombocytopenia, leukopenia.	- Assess any GI toxicity (severe nausea, vomiting, or diarrhea and report to the doctor. -Administer Dexamethasone eye drops /6 hours with HD ARA-C. - Assess any visual changes and report to the doctor. - Monitor vital signs as ordered. -In case of fever ask doctor before blood culture with **HD ARA-C** -Assess for any focus of infection after administration.
6-MERCAPTOPURINE (6-MP) (Purinethol)	-If patients not able to swallow 6-mp prepare 6-mp syrup by the pharmacy are now available. -Avoid long exposure to light. -Use mask & gloves when handling and administering drug.	-Increase liver function -Hyperbilirubinemia. <u>-Myelosuppression</u>	-Take at bedtime on empty stomach to increase absorption (2 hours after eating). -Ask patient to NPO before and after giving drugs 2 hour due to absorption and absorption decreased by the presence of food in the gut. - Monitor liver function before administration and report to the doctor. **<u>See below in table 3</u>**
Consolidation			
Intrathecal chemotherapy	**(see above)**		
Interim Maintenance	-Patients with hepatic/renal GIII/IV toxicity, fungal infection, or recent cerebral thrombosis receive interim maintenance until they are fit for receiving consolidation.		

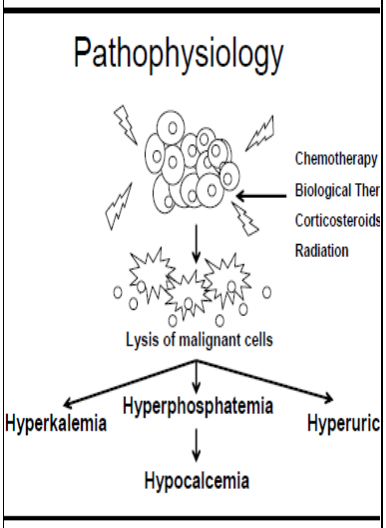
	-Interim Maintenance consists of 6MP, Methotrexate (MTX) Intramuscular (IM) and Ith.		
Methotrexate	-Stored at room temperature in a dark place. -Patients with ***Down Syndrome*** patients receiveing lower MTX doses; and Calcium leucovorin starts earlier --10 % of MTX dose take over 1 hour. --90% of MTX dose take over 23 hours. --Check chest x-ray to detect no pleural effusion. -Creatinine clearance ≥70 ml/min. -If patient is less than 3 years, detect serum creatinine. -In patients with renal dysfunction -- do renal scan -Leucovorin (folinic acid) is usually started 42 hours after the end of methotrexate infusion to prevent severe toxicity.	-Nephrotoxicity	- Hydration and monitor fluids intake and output is very important before, during, and after receiving HDMTX to prevent renal impairment and decrease toxicity. - Maintaining a urine PH > 7 daily to prevent drug precipitation in renal tubules and decrease the chance of renal damage. - Urinary alkalinization is most easily accomplished by adding medication as sodium bicarbonate to the patient's IV fluids as doctor_order. -Monitoring lab result (CBC-BUN levels, electrolytes, serum Creatinine, renal function, LDH and uric acid creatinine clearance) as doctor order. -Patients should be monitored for signs and symptoms of fluid volume overload, as peripheral edema, neck vein distension, weight gain, and pulmonary crackles, as well as signs and symptoms of fluid volume deficit (dehydration) as dry mucous membranes, poor skin turgor, weight loss, and thirst and report to the doctor. - Methotrexate may be "sequestered" in body fluid collections (i.e. pleural effusion, wound vac, pseudomeningocele, GI obstruction, ascites) and eliminated slowly from these areas. Patients with any evidence of a fluid collection should have plasma concentrations monitored until they are below the concentration of

	-Stop sutrim before HDMTX administration (24 hr.). - Do not administer this medication with MTX as order (NSAIDs prior to or during high-dose methotrexate therapy, as these agents may increase and prolong serum methotrexate concentrations. -Vitamins containing folate may decrease response to systemic methotrexate; folate deficiency may increase methotrexate toxicity. -Proton pump inhibitors (i.e. omeprazole, pantoprazole) may decrease the excretion of methotrexate. -Penicillins may decrease the excretion of methotrexate. Azole antifungals (i.e., fluconazole, posaconazole, voriconazole) may cause a concomitant rise in LFTs and may affect excretion of		detection as doctor order. - Report any signs of toxicities frequently as nausea and vomiting, diarrhea, anorexia, alopecia, and hepatotoxicity to the doctor -Monitor intake and output to ensure adequate fluid balance and to ensure the patient is voiding If a patient has not urinated, they may require medication as doctor order. -Assess urine output, including pH, color, odor, volume, and clarity to assess patient renal function. -Assess patient symptom as oliguria which may indicate acute renal failure. -Assess any episode of hypotension or suspected sepsis within the first 48 hours of receiving HDMTX and report to the doctor. -Methotrexate concentrations should be obtained daily at prespecified times according to individual protocols & leucovorin dose modified accordingly. - Administration of blood products during HDMTX infusions should be avoided if possible until the patient has cleared MTX. If a patient is symptomatic and requires a blood transfusion notify the doctor. - Monitor CBC and Cr in patients with toxicity and modify 6-mp accordingly - Monitor MTX level and management of

	MTX)	-GI Mucositis	toxicity as order and monitoring parameter till MTX level is ND -Restart leucovorin earlier patients with previous of GIII/IV GIT toxicity. --Provide instruction on proper mouth care, nutrition, and hygiene. - Follow the guideline in the **table 3**.
		-Hepatotoxicity	-Monitor liver function before administration.
		- Neurotoxicity	-Assess level of consciousness. -Assess any signs and symptoms and report to the doctor.
		Neutropenia	- Follow the guideline in **the table 3**.
Mercaptopurine (6-MP) given daily (see above)	Patients may experience myelosuppression (esp. with MTX toxicity); in such case, 6MP modification is to be considered as doctor order.		
Re-intensification	Re-intensification consists of a combination of Etoposide (VP16), HD Cytarabine (HD-Ara C), Dexamethasone, Asparaginase and Ith. Based on response to therapy, some patients might receive their second re-intensification cycle as FLAG/M. This consists of Fludarabine, HD-Arac, Mitoxantrone and ITH.		
Etoposide (Toposar, VP-16, VePesid) **in infantile**	-Stored at room temperature	Hypotension.	-Measure vital signs and blood pressure before starting the Etoposide infusion and report to the doctor. - Monitor patient closely for anaphylactic

Protocol			reaction as (chills, fever, tachycardia, bronchospasm, dyspnea, hypotension) and report to the doctor. --Check IV site before, during and after infusion. - Monitor for Lab tests as doctor order. -Protect patient from any trauma that might precipitate bleeding during period of platelet nadir particularly. -Assess any signs as blood dyscrasias, alopecia before treatment begins and report to the doctor. - Changes patient position slowly, from lying to upright position because transient hypotension after therapy is possible as order.
Continuation	Combination of Mercaptopurine, Intrathecal, Leucovorin, doxorubicin, Vincristine, Asparaginasee, Cyclophosphamide and cytarabine **(All see above)** **Doses and schedules differ according to patients' risk stratification.**		

10.Oncologic Emergencies and Nursing Management (Table 2)

Oncologic Emergencies	***Definition***	***Clinical Presentation***	***Nursing intervention***
Tumor lysis syndrome -Usually occurs within 24 to 48 hours of initiation of therapy. -Can rarely occur later in treatment course (up to 7 days after therapy initiation. -Effects may persist for 5-7 days -Can occur spontaneously	-It is a metabolic disorder that results from the rapid release of intracellular contents into the circulation upon the rapid death of cells	-Hyperkalemia(K+). -Hyperuricemia (uric acid). -Hyperphosphatemia (PO4). -Hypocalcaemia (Ca++).  	***-Initial measures to prevent TLS (Hydration (no potassium added), allopurinol, sevelamer (or epicogel) are given to the patient at admission.*** ***-Patients continue to be closely monitored.*** *-Maintain adequate hydration as per physician order.* *-Closely monitor input and output, avoid positive balance* *-Closely monitor KFT (serum creatinine)* ***Note:*** Some patients may need dialysis to filter the blood until the kidneys heal as doctor order. ***Hyperkalemia (K+)*** **Definition** -Hyperkalemia is defined as a serum or plasma potassium level above the upper limits of normal (3.5-----5 mmhg), usually greater than 5.0 mEq/L to 5.4 mEq/L which may cause life-threatening cardiac arrhythmias, arrest, or sudden death.

		Risk of TLS – Tumor Type Degree of Risk / Tumor Type High: * Burkitt's lymphoma * High-grade non-Hodgkin * Lymphoblastic leukemia * T-cell acute leukemia * Other acute leukemias Moderate: * Low-grade lymphoma treated with definitive therapy * Multiple myeloma * Breast carcinoma treated with chemotherapy/hormo * Small-cell lung carcinoma * Germ-cell tumors (seminoma, ovarian) * Neurob Low: * Hodgkin's lymphoma * Low-grade lymphoma treated with interferon * Medulloblastoma * Merkel's cell carcinom * Adenocarcinoma of the gastrointestinal tract	***-Intervention*** -More than upper normal level: monitoring more frequently of potassium level till the level normalize. - Rapid increase in K+ level in high-risk patients or patients with other signs/symptoms of lysis warrants close monitoring (more frequent sampling). -Monitor patient's vital signs (temperature, pulse, respiration and blood pressure, report any tachycardia or arrhythmia and report to doctor any abnormality. -Drawing labs per orders. - Assess neuromuscular manifestations as muscle weakness and irritability, cramping, twitching or GI irritability as nausea, vomiting, intestinal colic and diarrhea. and report to the doctor -Give Patients Calcium Gluconate to Stabilizes cardiac membranes as order. -May require EKG monitoring as order. -Confirm intravenous fluid does not contain potassium (k+) (refer to doctor); revise input and output and report the doctor. Avoid positive balance. -Give patients medication as Loop diuretics (Lasix) renal excretion of potassium (in addition to fluids and phosphate) is increased through the

			inhibition of sodium and chloride reabsorption as doctor order. -According to physician order, patients may require continuous infusion of Glucose/Insulin until K+ level declines. *Monitor Blood sugar level and K+ level.* **<u>Hyperuricemia (uric acid)</u>** -Rapid release and catabolism of intracellular nucleic acids (purines). -Typically occurs 2-3 days after starting therapy -Uric acid secretion occurs distal to the renal proximal tubule -High concentrations of uric acid may lead to the formation of uric-acid crystals in the distal tubules and collecting ducts. -Monitoring Uric acid as order -Assess any signs and symptoms as nausea, vomiting, lethargy, agitation, hypertension, renal dysfunction and the formation of renal stones and notify the doctor. -Monitor fluid balance between input and output, report to the doctor. -Give patients intravenous fluid as doctor order.

			-Give patients medication as diuretics (Lasix) -Confirm patient is taking allopurinol at a correct dose, dose increase maybe required as per physician order. -Patients whose uric acid level is very high may require rasburicase (if available) -Rasburicase breaks down uric acid within four hours -For patients receiving rasburicase, Blood specimens for uric acid levels should be placed on ice immediately to prevent further degradation of uric acid. ***N.B.*** Children with G6PD deficiency should not receive rasburicase. **Hyperphosphatemia (PO4)** -Give patients medication as diuretics (Lasix) -Give Aluminum hydroxide (Epic gel) with meals to Prevents gut reabsorption of phosphate as doctor order (Epicogel should be separated from other drugs, refer to the clinical pharmacist) - Sevelamer (Renagel) Cationic polymer that binds intestinal phosphate via ion exchange and hydrogen bonding Give with meals and do not break, crush or chew tablets as doctor order.

			- Monitor patient weight and report to the doctor. **<u>Hypocalcaemia (Ca++)</u>** – Hypocalcemia induced by hyperphosphatemia. -Keep air way patent. -Assess any signs and symptoms as tetany, confusion, irritability, laryngospasm, tingling of extremities, convulsions, carpopedal spasms, altered consciousness or hypotension and report to the doctor. -Give patients medication as Calcium Gluconate if the patients manifested with symptoms and signs of hypocalcemia as doctor order. - Ideal management is correction of hypophosphatemia.
Hyper leukocytosis	**-I**s defined if total leukocyte counts TLC > 100,000 cells/mm3 -Risk of Hyper viscosity (Increases blood viscosity).	-Shortness of breathing, -Oliguria or anuria -Blurred vision or papilledema	-Don't give blood transfusion in patients with hyperleukocytosis except in patients with severe symptoms of anemia and as order related to blood viscosity. - Anesthesia (during BMA or ITH) should be avoided in patients with hyper leukocytosis. -Assess any signs and symptoms and report to the doctor. -Monitor patients' weight as order, edema may develop secondary to renal

			insufficiency. -Monitor urine output and report to the doctor. -Monitor electrolytes and chemistry as creatinine, uric acid, potassium, phosphorus and calcium as doctor order. -IV Hyper hydration as doctor order. -Prompt initiation (early start) of steroids +/- hydroxyurea may be required as per physician order. -Other chemotherapy to be initiated according to physician order.
Typhlitis	**-I**t is an inflammation of the colon that results in necrotizing colitis	-Fever, severe right lower quadrant pain, abdominal distension and nausea vomiting and diarrhea which Usually occurs 7-14 days from initiation of chemotherapy	-Assess any signs and symptoms and report to the doctor. - Assess neutrophil count (in case of severe neutropenia) occur complications as sepsis, bowel infarction, necrosis of cecum, perforation, ostomy, and death. -Maintain intravenous fluid replacement (remember the patient is NPO) as order. -Patient may need to total parenteral nutrition (TPN) or nasogastric tube (NGT) as recommended by the doctor. - Give antibiotics as per medication order. -Assess pain degree and pain

			management as order. --Skin, oral and perianal care to prevent breakdown and maintaining the integrity of these sites that help the patient fight infection. -- Monitor patient vital signs to assess any deterioration (septic shock) and report to the doctor. -Monitor patient labs (electrolytes) as order and report to the doctor.
Spinal Cord Compression	**I**t is Compression of the vertebrae as a result of tumor invasion resulting in collapse of the spinal cord or increased pressure in the spinal canal.	-Neck, back pain. -Weakness, bowel and bladder dysfunction. -Paresthesias / paralysis, muscle atrophy and loss of pain or temp sensation.	-Assess any signs and symptoms and report to the doctor. -Assess pain degree and pain management as order. -Frequent repositioning and range of motion exercise as order. - Should start Chemotherapy (per order) as early as possible to avoid more complications.
Superior Vena Cava Syndrome(svcs)	**I**s defined as the internal or external obstruction of the SVC reducing blood return to the heart, results in venous congestion, pulmonary and cerebral compromise	-Dyspnea, cough. -Tachypnea. -Headache, chest pain, -Edema of face, neck, and upper extremities.	- Assess any signs and symptoms and report to the doctor. -Give patients medication as order. -Avoid CNS depressants as local anesthetic for procedures, analgesia cautiously -Avoid venipunctures and BP measurement to upper extremities related to edema. -Monitor CBC, Chemistry, urine analysis

			as order. -Should start Chemotherapy (per order) as early as possible to avoid more complications occur. -Monitor the oxygenation levels by pulse oximetry -Give the patient supplemental oxygen (positioned to minimize obstruction) as order. -Maintaining a calm environment. -Place the patient in an upright position (45 degrees) as order. -Monitor patient's intake and output and report to the doctor. -Maintain patient's airway. -Weigh the patient as order and report to the doctor.
Increased Intracranial Pressure (ICP)	**I**t is the dynamic pressure relationship within the cranium between the brain tissue, cerebral circulation, and cerebral spinal fluid. Risk Factors: CNS tumor, hemorrhage, stroke, hydrocephalus.	-Morning headaches. -lethargy. - Nausea, vomiting and fatigue. -In Infants (increased irritability increased head circumference, bulging fontanels and irregular respirations).	**-Give patient medications as** doctor order **to relieve** cough and pain (coughing and pain can cause a vasovagal response that can increase intracranial pressure). -Assess any signs and symptoms and report to the doctor. -Neurologic Assessments **(**levels of consciousness, occurrence of seizures, response to verbal commands, change in gait) and notify the doctor. -Complete history and assessment and

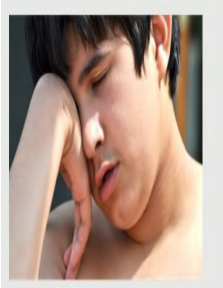
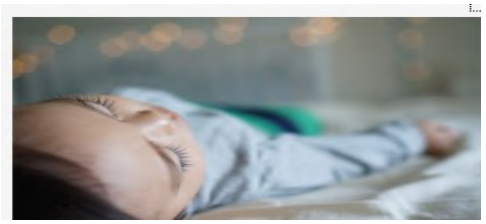
			documentation -Assess patient position and report to the doctor. -The head of the bed should be elevated to promote venous drainage as order. -Measure BP and Temperature and report to the doctor. -Monitor intake and output and report to the doctor. -Measure patient weight and report to the doctor. -Assess dehydration measure and Administer steroids, Mannitol / Lasix as per doctor order.
Convulsion (Seizures)	**I**s define as: physical findings or changes in behavior caused by uncontrolled electrical firing or discharges from the nerve cells of the cerebral cortex and are characterized by sudden, brief attacks of altered consciousness, motor activity and sensory phenomena.		***Risk of aspiration*** -Provide air way to prevent tongue bit or falling. -Report to physician & give anticonvulsant drugs as order. -Lateral position for secretion come out. -Monitor vital signs till patient become alert & report any abnormality. -Support breathing & O2 therapy. -Suction if needed as order. -Don't try to force anything in mouth e.g. (tongue depressor).

			-Don't give patient food or liquid till he is fully alert. -Neurological assessment post convulsion. -Assessment convulsion causes. ***Ineffective Airway Clearance*** -Assess the child's airway patency using the look, listen and feel approach. This will ensure that seizure does not affect the supply of oxygenated blood to the brain and prevent the development of hypoxia. -Place the child on a flat surface then turn the head on the side during a seizure episode. Turning the child's head to the side helps in maintaining a patent airway by promoting drainage of secretions and avoid aspirations to the lungs. -Loosen any restrictive clothing, especially on the neck, chest, and abdomen. This will facilitate ease of breathing and maintain an unobstructed airway. -Suction secretions gently as indicated. Suctioning will eliminate secretions and decreases the possibility of aspiration. -Provide supplemental oxygenation as indicated. Oxygen therapy is prescribed to improve oxygen saturation and reduce possible complications.

			-Risk of injury related to impair level of conscious - Protection of the patient from self-injury and environmental injury during seizures and keep environment calm & clean. - Do not try to stop the seizure once it has started. -Keep bed side rails up. -Hold I.V line to avoid unnecessary variation in position Cannula -If Patient seated when seizure occur lie on the floor. - Loosen restrictive clothing, and remove eyeglasses or any device that may be harmful (hair clips, bows, etc…). - Place the patient on his or her side to facilitate drainage of saliva and to maintain a patent airway. -Allow Patient to sleep post seizure -Don't restrain patient - Place a pillow or blanket under the patient's head. -Monitor level of consciousness. - Do not give the patient food or liquids until he or she is fully alert and the swallowing reflex has returned.

			-Anxiety related to knowledge deficit about -Provide explanation, information about seizure & anticonvulsant drugs. -Support parents calm. Potential urinary, fecal incontinence occur. -Change the linen if needed. -Provide draw sheet before seizure if possible. -Morning &evening bed time care, oral hygiene, partial bath, nail cutting. -Instruct patient or his family to keep record of event surround his/her seizure (number, duration, time, &sleep …).

11. Nursing Management of General Side Effects of Chemotherapeutic Drugs (Table 3)

Problem	***Definition***	***Clinical Presentation***	***Nursing intervention***
Fatigue 	It is a feeling of tiredness or lack of energy It may be sudden or gradual in onset.	-Feeling worn out, drained. -An overall lack of energy that does not go away with rest or sleep	-Fatigue during chemotherapy is different from everyday fatigue. -Assess any signs and symptoms and report to the doctor. -Promote a restful environment. -Keeping to a sleep schedule and creating a comfortable sleep environment can lead to improved sleep and less fatigue. -Eat and drink well with foods high in protein and calories. -Assess patient's likes and dislikes. -Keep lights and noise to a minimum overnight to encourage patients to sleep and reduce feelings of fatigue. -Complementary therapies as (music therapy, art therapy, relaxation techniques, massage therapy). -Conserve energy & rest when tired. 

Neutropenia.	**I**t is the term that refers to a reduced number of circulating neutrophils (absolute neutrophil count, or ANC, of less than 1500 cells/mm3. The most serious risk of infection occurs when the ANC is <500 cells/mm3). --Decrease neutrophil count lead to increased risk of serious bacterial infections ,sepsis which can lead to deterioration, hemodynamic shock, and even death if not treated in a timely manner!	-Fever and infection -Vomiting, diarrhea. 	- Assessing patients from head to toe is important in order to pick up subtle signs of infection. -Assess any signs and symptoms as fever, redness, swelling, discharge, chills, shaking, flushed appearance, runny nose, sore throat, cough, or diarrhea and report to the doctor. -Monitor patient vital signs (temperature, pulse, respiration and heart rate) and report any abnormalities to the doctor according to schedule of vital signs (follow the guideline in **table 1**). -Avoid taking the patient's temperature rectally according to hospital policy. Please click on the link below: http://10.250.1.6/pp/08-57357-NURSING%20DEPARTMENT/02-NURSING%20POLICIES/01-GENERAL%20POLICIES/PP-NUR-021-Vital%20Signs%20Monitoring.pdf - Nursing care to prevent infections includes careful line care, hand hygiene, oral hygiene, daily baths, and proper isolation precautions. - Line Care should always be done using aseptic technique, ensuring there is no contamination of the catheter, tubing, or dressing as hospital policy. -Assess the site for signs of infection, such as discharge or redness. IV tubing should be changed as hospital policy to prevent

			infection - Complete blood count, blood cultures, a urinalysis and urine culture, a chest x-ray if the patient has respiratory symptoms, and stool cultures if the patient has diarrhea or other GI symptoms as ordered. -Administering medications to prevent or treat infections as order. -In case of infection, administer antipyretic and antibiotics as ordered and other medications as per physician protocol for neutropenia. -Monitor hydration status and give fluids as doctor order. -Use good hand-washing according to hospital policy. Please click on the link below: http://10.250.1.6/pp/09-INFECTION%20CONTROL%20%26%20PREVENTION/1.%20GENERAL%20IPC/PP-IPC-005-Hand%20Hygiene%20.pdf -Provide adequate nutritional intake. -Give patients education about: - Signs and symptoms as fever, redness, swelling, discharge, chills, shaking, flushed appearance, runny nose, sore throat, cough, or diarrhea. - How to measure a temperature at home. - Avoid large crowds

			-Perform respiratory etiquette: cover coughs and sneezes with the inside of the elbow or a tissue to prevent exposure to respiratory secretions. -Perform hand hygiene Personal hygiene guidelines, including daily baths, oral care, and perineal care, especially for diapered children.
Potential respiratory infection	-	-Chest or nasal congestion. -Wet or dry cough -Runny nose -Fatigue -Body aches -Low-grade fever -Sore throat.	-Assess any signs and symptoms and report to the doctor. - Assess any pain symptoms, level and report to the doctor. -Monitor vital signs and report abnormalities -Respiratory assessment -Oxygen saturation Q8 hours or more frequently as doctor order. -Encourage patient to move around in room unless contraindicated.
Skin changes	-	- Skin redness, itchy skin - Dryness, flaking - Burning, stinging, or tingling - Rash or acne-like bumps -Cracks or breaks in the skin. - Changes in skin color. - Blistering or peeling. - Fragile, thin skin.	-Assess any signs and symptoms and report to the doctor. - Keeping the skin clean and moisturized and protecting skin from irritation, injury, and infection. -Give patient medication as order. -Treat skin gently. Avoid rubbing, scrubbing, or scratching irritated skin -Moisturize dry skin as instructed by the care team. Make sure products are

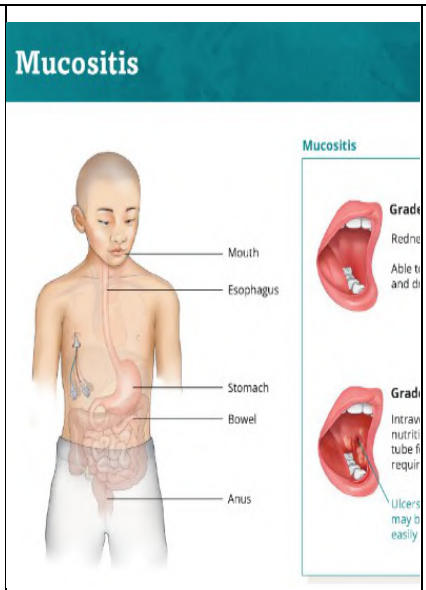
		- Changes in nails. - Sensitivity to sun.	alcohol-free, fragrance-free, and hypoallergenic. -Wear soft, loose fitting clothes. -Check to make sure that clothes, shoes, and medical devices do not rub or chafe the skin -Take warm (not hot) baths and showers. -Preventing dehydration and overheating -Storing water, fat, and other products that affect the metabolism. -Wear long sleeves and hats when outdoors to protect a child's skin. -Limit outdoor time as much as possible, particularly between 10am to 3pm when the sun is strongest. -Drinking plenty of water and other fluids -Protecting skin from the cold and wind and protect skin from the sun. -Avoiding dry heat. -Keeping fingernails trimmed.
Alopecia	-Hair loss (alopecia) is a common side effect of some cancer treatments including chemotherapy and radiation therapy. The cells that control hair growth are fast-growing cells and can	-Hair loss	-Explain hair loss is temporary, and hair will grow when drug is stopped. -Avoid excessive brushing and combing of the air. - use a hairbrush with soft bristles or a wide-tooth comb. -Do not use hair dryers, irons, or products such as gels or clips that may hurt your

	be damaged by treatments that attack cancer cells		scalp. Wash the hair very gentle and dry it with a soft towel. -Select wig, cap, scarf or turban before hair loss occurs. -Use sunscreen or wear a hat when you are outside and keep head covered in summer to prevent sunburn and in winter to prevent heat loss. -Be Gentle When the hair starts to grow back and avoid too much brushing, curling, and blow-drying -Do not use vitamins, supplements, or topical hair growth products without talking to a doctor
Thrombocytopenia, bleeding and bruising	-Thrombocytopenia decrease in the number of platelets in the blood) - **Bruising:** A bruise, or contusion, is skin discoloration from a skin or tissue injury. - Bleeding (hemorrhage) is blood escaping from the circulatory system from damaged blood vessels. Which can occur internally, or externally either through a natural	-Bleeding. - Urine that is red or pink. -Stools that are black or bloody. -Headaches. - Vision changes - Feelings of confusion or sleepiness.	-Wear shoes, even when inside to protect patient from injury. -Avoid physical activities that may result in bruising or injury. -Avoid taking rectal temperature, enemas, and suppositories. -Avoid sharp foods such as tortillas that can cause gum injury and bleeding. -keep stools soft using prescribed laxatives and stool softeners to avoid injury. -Maintain the integrity of the skin. -Prevent the use of tourniquets. -Avoid activities with the highest potential

	opening such as the mouth, nose, ear, urethra, vagina or anus, or through a wound in the skin		for physical injury. -Assess skin, stools, urine, gums, emesis, sputum, and nasal secretions for blood. -Review laboratory reports for the platelet count and alert the healthcare team. -applying pressure directly to all needle puncture sites for 5 minutes to prevent and decrease the risk of bleeding. -Reducing the risk of constipation by administering a prescribed stool softener. Providing safe environments. -Give Patient education about: -rinse mouth with ice or cold water in gum bleeding. -Nose bleeding — While your child is sitting up straight, apply pressure to the outsides of each nostril, just below the bridge of the nose. Pinch the area with the thumb and finger and hold gentle pressure for 5-10 minutes. -Other bleeding — Apply gentle pressure with a clean cloth to the area until bleeding stops.
Nausea and Vomiting	-Nausea is the feeling of sickness or discomfort that a person associates with the urge to vomit. -Vomiting, or	-Pain, loss of appetite, diarrhea, or constipation.	-Teach patient to sit upright after vomiting. -Eat small snacks and meals. -Eat and drink slowly. -Avoid having liquids with meals.

	throwing up, occurs due to the action of the diaphragm and abdominal muscles. These muscles contract and push stomach contents up the esophagus and out the mouth		-Avoid spicy, acidic, or rich foods. -Eat in a place that does not have strong smells. -Allow the child to choose like and dislike food. -Keep a record of symptoms. =Write down when nausea occurs, what makes it worse, what makes it better, and any other symptoms such as pain, loss of appetite, diarrhea, or constipation. -Do not offer favorite foods when child is nauseous. -Avoid lying down flat after meals. -Make sure to rinse the mouth after vomiting, stomach acid can cause mouth irritation and tooth decay. -Sip liquids slowly throughout the day. -Relax and take slow, deep breaths. -Avoid unpleasant sights, odors & taste - Monitor the frequency & amount (if possible) of vomiting, report to the physician -Administer antiemetic to prevent or minimize nausea as doctor order. -Administer IV fluids as per order. -Monitor fluid and electrolyte status as doctor order.

Diarrhea	It is a condition where stools become loose or watery and occur more often	-Cramping or lose control of bowel movements	-Monitor number, frequency and consistency of diarrhea stools. -Assess any serious health problems such as dehydration, malnutrition, and metabolic imbalances and report to the doctor. - Administer IV fluids +/- medications as per order - Closely monitor electrolytes and fluid balance - Stool Cultures & other lab tests may be required -Avoid eating high roughage, greasy and spicy food. -Eat low residue diet high in protein and calories -Drink well each day and eat small frequent meals -Eat slowly and chew all food thoroughly. -Clean metal area after each bowel movement.

Oral Mucositis	Mucositis is a swelling of the mucous membrane, the moist, inner lining of some body organs. -Mucositis can occur anywhere along the digestive tract including the mouth, stomach, intestines, and anus. It often results in painful sores.	 -	**For prevention** -Use small, extra soft bristled tooth brush, to soften bristles, rinse toothbrush under warm water for about 30 seconds (Use nonabrasive, fluoride toothpaste with a neutral taste-flavoring agents may irritate gums) -Brush all tooth surfaces using a short circular motion or horizontal strokes. -Brush tongue back to front -Rinse toothbrush well after each use; allow to air dry -Replace toothbrush when bristles are no longer standing up straight -Oral rinses help keep mouth moist and clean by removing debris After brushing, rinse mouth a minimum of four times daily -Use water oral rinse, swish in oral cavity for 30 seconds, then spit out. -Apply after oral care, at bedtime or as often as required -Daily fluid intake of 8-12 cups (2-3 liters). -Well balanced diet that is high in protein, -Use soft, moist, bland foods as symptoms develop. -Discourage foods/fluids that may not be well tolerated or that may promote dental

			caries -Educate patient and family of how to perform daily oral assessment at home. -Provide contact information and reinforce with patient/ family when to seek immediate medical attention if the following emergent conditions develop: - = Temperature greater than or equal to 38° C, presence of white patches, swelling, redness, foul odor – possible infection. =Difficulty breathing– respiratory distress. =Bleeding lasting longer than 2 minutes– possible thrombocytopenia. =Unable to eat or drink fluids for more than 24 hours– risk for dehydration. =Increased difficulty swallowing– reflective of severity of symptoms. =Uncontrolled pain- reflective of deteriorating patient status and severity of symptoms. - Follow oral mucositis guidelines for assessment & management as hospital policy. Please click on the link below: http://10.250.1.6/pp/10-HOSPITAL%20PROGRAMS/PROG-014-Oral%20Health%20Prevention%20and%20Managing.pdf

Sepsis and Septic shock	**- S**epsis can quickly progress to septic shock **- S**eptic shock is a more progressive stage of sepsis, defined by persistent hypotension that does not respond to fluid resuscitation. -**S**epsis: The clinical suspicion of infection and evidence of a systemic response (combination of two or more of hypothermia (<36° C), hyperthermia (>38° C), tachycardia, tachypnea, leukocytosis, or neutropenia.	- Signs and symptoms of sepsis as May or may not be ill appearing, tachycardia, tachypnea, warm, flushed skin, normal blood pressure, normal urine output, bounding pulses - Signs and symptoms of Septic shock as while typically ill-appearing, these patients may be well appearing upon arrival so do not base on looks alone, tachycardia, tachypnea, cool, dry skin, hypotension that is persistent and is not resolved with fluid resuscitation, weak or absent peripheral pulses, decreased capillary refill, decreased (or even absolutely no) urine output/	-Assess for signs and symptoms and notify the doctor. - Complete head to toe assessment to detect any abnormality and report to the doctor. - Complete physical assessment thorough assessment of most common infection sites (mouth, rectum, central line site, any surgical sites or skin lesions) and assess any signs of infection and report to the doctor. -IV bolus fluids per order -Obtain blood cultures prior to IV antibiotics as order - Early initiation of antibiotics (STAT) as doctor order. - Obtain Complete Blood Count, Electrolytes and Urinalysis/Urine Culture per order -Assess level of conscious. -Monitor vital signs (heart rate, breath sounds, blood pressure and temperature -Monitor, urine output, bleeding and notify the doctor. - Monitor intake and output and report to the doctor. - Assess for signs and symptoms of pain and report to the doctor.

Disseminated intravascular coagulopathy (DIC)	It is a systemic activation of coagulation that results in the consumption of coagulation factors that are greater than the body's ability to replace them.	-Ischemic changes in skin, liver, kidneys, gut. -Cerebral dysfunction or petechiae, ecchymosis, purpuric rash, bleeding or hypotension.	-Assess for signs and symptoms and report to the doctor. -Assess tissue perfusion, color, temp, peripheral pulses, mental status, urine output, respiratory status. -Monitor lab values for thrombocytopenia, anemia, prothrombin time (PT), partial thromboplastin time(PTT), fibrinogen, fibrin Degradation products, Fibrin Split Products or D-dimer and notify the doctor. -Direct pressure to bleeding sites and elevate site. -Administer blood products to treat thrombocytopenia or anemia as order.

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