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Madhya Pradesh

Nursing Officer

Madhya Pradesh Employees Selection Board (MPESB)

Volume - 3

SIERRA INNOVATIONS

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1 CHAPTER Oncology

Introduction to Oncology

- **Oncology** → Branch of medical science dealing with **neoplasms (tumors)**.
- **Neoplasia** → Process of new, abnormal tissue growth.
- **Neoplasm (Tumor)** →
  - ✓ Abnormal mass of tissue.
  - ✓ Growth **exceeds** & is **uncoordinated** with normal tissue.
  - ✓ Persists even after removal of stimulus.

Types of Tumors

Feature	Benign Tumor	Malignant Tumor
Nature	Innocent, non-cancerous	Harmful, cancerous
Growth	Slow, localized	Rapid, invasive
Capsule	Well capsulated	Non-capsulated
Differentiation	Cells resemble normal tissue	Poor/absent differentiation
Metastasis	Absent	Present
Recurrence	Rare	Common
Prognosis	Good	Poor if untreated

Cancer word derived from **Greek "Karkinos = Crab"** → spreads in all directions like crab movement.

Cell Growth & Cell Cycle

Cell cycle = **sequence of growth & division of a cell**

Phases of Cell Cycle

Phase	Description
M Phase (Mitosis)	Cell division → 10% of cycle
Interphase	Cell prepares for division → 90% of cycle
G0	Resting phase (non-dividing)
G1	Gap 1 → RNA & protein synthesis, cell growth
S Phase	DNA replication (Synthesis)
G2	Gap 2 → Protein synthesis, energy storage, preparation for mitosis

- **M Phase** = Active division (shortest phase).
- **Interphase** = Longest phase (where cancer cells often lose control).

General Features of Cancer Cells

- Uncontrolled growth
- Loss of differentiation (Anaplasia)
- Ability to invade & metastasize
- Altered cell surface antigens
- ↑ Nucleus-to-cytoplasm ratio
- Resistance to apoptosis

Mnemonic: "CANCER"

- **C** – Continuous growth

- **A** – Anaplasia (loss of differentiation)
- **N** – New antigens (abnormal cell markers)
- **C** – Cell invasion & metastasis
- **E** – Enlarged nucleus (high N:C ratio)
- **R** – Resistance to apoptosis

Cancer & Tumours

Cancer

- A condition where cells show **loss of control in cell cycle**.
- In cancer:
  - ✓ **90% time → M-phase** (mitosis, abnormal rapid division)
  - ✓ **10% time → Interphase** (resting phase, minimal control)

Types of Malignant Tumours

Tumour Type	Origin	Examples	Danger Level
Carcinoma	Epithelial cells	Skin, lung, stomach, colon	Less dangerous
Sarcoma	Connective/mesenchymal tissue (muscle, bone, cartilage)	Osteosarcoma, Rhabdomyosarcoma	**More dangerous**

Mnemonic: *"Car – Cover (epithelium), Sar – Support (connective tissue)"*

Cell Adaptations

Term	Definition
Hypertrophy	↑ Size of cells (after development)
Hyperplasia	↑ Number of normal arranged cells
Atrophy	↓ Size of cells (after development)
Metaplasia	Change of one adult tissue → another
Dysplasia	Abnormal tissue growth; loss of cell regularity, variability in size/shape

Dysplasia Stages

- **Mild Dysplasia** → Early changes
- **Moderate Dysplasia** → Progressing abnormality
- **Severe Dysplasia / Carcinoma in situ** → Malignant cells **confined within basement membrane**
  Carcinoma in situ = Pre-cancerous, curable stage
- Cytological features of malignancy but **no invasion**
- If untreated → progresses to invasive cancer

Examples:

- Leukoplakia (white oral patches)
- Chronic gastritis
- Chronic smoking (colon, lung)

Iodine Staining Test

- **Normal squamous epithelium of vagina & cervix**:
  - ✓ Contains **glycogen** → stains **brown with iodine**
- **Cancer cells**:
  - ✓ No glycogen → **do not stain with iodine**

  Clinical tool for **precancerous detection**.

Invasion

- **Definition**: Spread of malignant cells into surrounding tissue.

- **Benign Tumour** → Encapsulated, no invasion
- **Malignant Tumour** → Non-capsulated, infiltrates tissues

Special Features of Malignant Cells
- Have **30% less Ca^{2+}** than normal → poor adhesiveness → easy detachment → invasion/metastasis
- **Invasion = hallmark of malignancy**

Hypocalcemia in Cancer
Seen in:
- Breast Cancer
- Bone Cancer
- Multiple Myeloma
- Parathyroid Cancer

Nursing Booster Points
- Carcinoma → epithelial origin
- Sarcoma → connective tissue, more dangerous
- Carcinoma in situ → pre-cancer, curable stage
- Malignant = invasion + low calcium + metastasis
- Benign = encapsulated, no invasion
- Iodine test → Normal = brown, Cancer = no stain

Risk Factors of Cancer (Carcinogens)
1. Endogenous (Non-modifiable)
- **Genetic/Hereditary**
- **Age**:
  - ✓ Prostate cancer common in **>40–45 yrs males**
  - ✓ Breast cancer risk ↑ with age
- **Race**: Some cancers more in specific ethnic groups
- **Sex/Hormones**:
  - ✓ Estrogen → Breast cancer in females
  - ✓ Testosterone → Prostate & Esophageal cancers in males

2. Exogenous Carcinogens
A) Physical
- Heat: *Kangri Cancer* (Abdominal skin cancer in Kashmiri people)
- Chronic irritation/trauma: Oral cancer in tobacco chewers
- Smoking: Lung, oral cancers

B) Radiation
- UV rays: Skin cancer
- X-rays / Radioactive exposure: DNA damage → mutations

C) Biological Agents
- **Bacteria**: *Helicobacter pylori* → Gastric cancer
- **Parasite**: *Schistosoma haematobium* → Bladder cancer
- **Fungi**: *Aspergillus flavus (Aflatoxin B1)* → Liver cancer
- **Viruses**:
  - ✓ HBV / HCV / HDV → Liver cancer
  - ✓ EBV (Epstein-Barr virus) → Lymphoma (esp. Burkitt's)
  - ✓ HPV → Cervical cancer
  - ✓ CMV (in AIDS) → Kaposi's sarcoma

D) Chemical Carcinogens

- Benzopyrene (tobacco smoke) → Oral & lung cancers
- Asbestos → Lung cancer (2nd most common after smoking)
- **Bleeding common** in cancers (fragile vessels).
- **Pain rare** in early stages (nerve involvement needed).
- **Oral Cancer (Chhota Cancer)** common in South India (tobacco, betel nut use).

Pathogenesis of Cancer

1. **Cell Mutation Theory** (most accepted) → Cellular transformation due to DNA mutations.
2. **Immune Response Failure** → Loss of immune surveillance against abnormal cells.

Classification of Cancer

Type	Origin	Examples
Solid Tumours	Organs	Breast, Lung, Stomach cancers
Hematological Tumours	Blood-forming tissues	Leukemia, Lymphoma, Multiple Myeloma

Nursing Booster Points

- Only **malignant tumours metastasize**.
- **Carcinomas → Lymph**, **Sarcomas → Blood**.
- **Most common organ of metastasis → Lungs**.
- **Most common organ of GIT metastasis → Liver**.
- **Krukenberg Tumour** = Stomach → Ovary.
- **N:C ratio normal 1:4 / malignant 1:1**.
- **Pain is a late feature; bleeding is common**.

Grading & Staging of Tumour

Grading of Tumours

Definition: Describes how closely tumour cells resemble the tissue of origin (degree of differentiation).

- **Differentiation** = Structural + Functional similarity to normal cells

Grade	Differentiation	Microscopic Features	Stage of Dysplasia
Grade I	Well differentiated	Cells slightly abnormal	Mild dysplasia
Grade II	Moderately differentiated	More abnormal than normal	Moderate dysplasia
Grade III	Poorly differentiated	Very abnormal	Severe dysplasia
Grade IV	Undifferentiated (Anaplasia)	Cell origin difficult to determine	Highly malignant

Mnemonic: *"Well → Moderate → Poor → None"* = G1 → G2 → G3 → G4

Staging of Tumours

Definition: Describes **extent of cancer clinically** → size, lymph node involvement, and metastasis.

- **Most widely used system → TNM Classification**

TNM Classification

Symbol	Meaning	Sub-classification
T	Size of Primary Tumour	T0 = No tumour Tis = Carcinoma in situ T1 = ≤2 cm T2 = >2 cm T3 = 3–5 cm T4 = >5 cm
N	Regional Lymph Node involvement	N0 = None N1 = 1 node N2 = >1 node N3 = All nodes involved
M	Metastasis	M0 = No metastasis M1 = Distant metastasis present

Stages of Cancer (Based on TNM)

Stage	TNM Code	Features	5-Year Survival
Stage 0	Tis N0 M0	Carcinoma in situ (pre-cancerous)	Curable
Stage I	T1 N0 M0	Localized tumour	70–90%
Stage II	T2 N1 M0	Limited local spread	~50%
Stage III	T3 N2 M0	Extensive local + regional spread	~20%
Stage IV	T4 N3 M1	Distant metastasis (advanced)	<5%

Key Notes:

- Stages I & II → Operable + Resectable
- Stage III → Extensive spread, poor prognosis
- Stage IV → Distant metastasis, worst survival (<5%)

Nursing Booster Points

- Grading = Microscopic (cell differentiation)
- Staging = Clinical (tumour size, nodes, metastasis)
- Carcinoma in situ = **Stage 0 (curable)**
- TNM → T = Tumour size, N = Node spread, M = Metastasis
- Stage I & II → Good prognosis
- Stage IV → <5% survival

Seven Warning Signs of Cancer

(Early detection guide – represented as CAUTION)

Letter	Warning Sign	Common Site / Example
C	Change in bowel or bladder habits	Colon (GIT), Kidney, Bladder
A	A sore that does not heal	Oral cancer, skin cancer
U	Unusual bleeding or discharge	Cervical cancer, rectal bleeding, breast discharge
T	Thickening or lump (anywhere in body) / Indigestion / difficulty swallowing	Stomach, esophagus
I	Indigestion or difficulty in swallowing *(Sometimes combined with T)*	Gastric cancer, esophageal cancer
O	Obvious change in wart or mole	Skin cancer, melanoma
N	Nagging cough or hoarseness of voice	Laryngeal, lung cancer

Mnemonic: "CAUTION"

- C – Change in bowel/bladder
- A – A sore not healing
- U – Unusual bleeding/discharge
- T – Thickening/lump or Trouble swallowing
- I – Indigestion/dysphagia
- O – Obvious change in mole/wart
- N – Nagging cough/hoarseness

Nursing Booster Points

- Used for early detection of cancer.
- If any sign persists for >2 weeks → immediate medical evaluation.
- CAUTION mnemonic is a must-remember for exams.

Early Detection & Diagnostic Procedures of Cancer

Early Detection Methods

- **Mammography** → Breast cancer screening
- **Pap smear test** → Cervical cancer (pre-cancerous lesions)
- **BSE (Breast Self-Examination)**
- **TSE (Testicular Self-Examination)**
- **Rectal & Stool Exam** → Occult blood (colon cancer)
- **Sigmoidoscopy / Colonoscopy** → Colorectal cancer
- **Skin inspection** → Skin cancers (melanoma, basal cell carcinoma)

  Mnemonic for screening: **"MAPS-TS"**
  (Mammography, Pap smear, Self-exam [BSE/TSE], Tests [stool], Scope [colonoscopy], Skin check)

Common Diagnostic Procedures

1. **History & Physical examination**
2. **Chest X-ray** → lung metastasis
3. **Blood Investigations**: CBC, RFT, LFT, PFT
4. **Hormonal & Enzyme Studies** (e.g. PSA, AFP)
5. **CT / MRI** → tumour location & spread
6. **Lymphangiogram** → lymph node involvement
7. **Mammography / Mammogram** → Breast carcinoma
8. **Direct Visualization**:
   - ✓ Gastroscopy → Stomach cancer
   - ✓ Colonoscopy → Colon cancer
   - ✓ Colposcopy → Cervix & vagina
   - ✓ Laparoscopy → Pelvic & abdominal cavity cancers
9. **Tumour Markers** (e.g. CEA, PSA, CA-125, AFP)
10. **Radioisotope Scanning** → Liver, Brain, Bone, Lungs
11. **Cytological Examination**:
    - ✓ Pap smear (Papanicolaou test) → Detects early cervical lesions
12. **Bone marrow examination** → Hematological malignancy (Leukemia, Lymphoma, Myeloma)

Biopsy – Confirmatory Test of Cancer

Biopsy is the gold standard & confirmatory diagnosis (Histological proof of malignancy)

Types of Biopsy

Type	Use
Incisional / Subtotal Biopsy	Large tumour → only part removed
Excisional / Total Biopsy	Small tumour → entire tumour removed (diagnosis + treatment)
FNAC (Fine Needle Aspiration Cytology)	Aspiration of cells with 25–26G needle → quick & less invasive
Bone marrow biopsy	If **hematological malignancy** suspected

Nursing Booster Points

- Early detection → Screening tests (Mammography, Pap smear, BSE/TSE, Colonoscopy, Skin exam)
- **Direct visualization** → Endoscopy methods (Gastro, Colo, Colpo, Laparo)
- **Tumour markers** → supportive, **not confirmatory**
- Confirmatory diagnosis = Biopsy
- Pap smear = Early detection (not confirmatory)

Common Tumour Markers & Associated Cancers

Tumour Marker	Cancer Association	Key Notes
AFP (Alpha-fetoprotein)	Hepatocellular carcinoma (Liver), Testicular germ cell tumours (non-seminoma)	↑ also in hepatitis, cirrhosis
CEA (Carcinoembryonic Antigen)	Colorectal cancer, Pancreatic, Gastric, Breast	Not specific – also ↑ in smokers
PSA (Prostate Specific Antigen)	Prostate cancer	Also ↑ in BPH & prostatitis
CA-125	Ovarian cancer	Also ↑ in endometriosis, PID
CA 19-9	Pancreatic cancer, Colorectal cancer, Gastric	Used for follow-up, not screening
CA 15-3 / CA 27-29	Breast cancer	For monitoring recurrence
β-hCG (Beta Human Chorionic Gonadotropin)	Choriocarcinoma, Testicular cancer (seminoma), Hydatidiform mole	↑ also in pregnancy
Calcitonin	Medullary carcinoma of thyroid	Produced by C-cells
LDH (Lactate Dehydrogenase)	Lymphoma, Testicular germ cell tumours	Indicates tumour burden
Chromogranin A	Neuroendocrine tumours (Carcinoid, Pheochromocytoma)	Useful in follow-up
S-100	Melanoma, Schwannoma, Neural tumours	Immunohistochemistry marker
Alkaline Phosphatase (ALP)	Bone metastasis, Liver cancer	Indicates bone/liver involvement

Nursing Booster Points

- AFP → Liver/Testis
- CEA → Colon
- PSA → Prostate
- CA-125 → Ovary
- CA 19-9 → Pancreas
- CA 15-3 → Breast
- β-hCG → Chorio/Testis

Mnemonic for Tumour Markers (A–Z order):

- **A**FP → **A**lcoholic Liver / Testis
- **C**EA → **C**olon
- **C**A-125 → **C**ervix/Ovary
- **C**A 19-9 → **C**arcinoma Pancreas
- **P**SA → **P**rostate
- **B**eta-hCG → **B**aby (Pregnancy, Chorio, Testis)

Management of Cancer

Cancer Screening (Secondary Prevention)

Test	Age / Frequency	Notes
BSE (Breast Self-Exam)	From age **20 yrs** Monthly (7–10 days after menses)	Clinical exam yearly

TSE (Testicular Self-Exam)	From age **15 yrs** Monthly	Clinical exam every 3 yrs
Cervical Cancer (Pap smear)	Start **after 18 yrs** OR within **3 yrs of 1st intercourse**	Especially for high-risk women
Prostate Cancer (PSA test)	After **40–45 yrs**	PSA = Prostate Specific Antigen

Booster Q: *Breast cancer → usually involves **lactiferous ducts***

Management of Malignant Tumours

Four Main Therapies

1. Surgery
2. Radiation Therapy (RT)
3. Chemotherapy
4. Biotherapy (Immunotherapy)

1. Surgery

- **Diagnostic Surgery** → Biopsy
- **Cytological specimen** → FNAC
- **Curative Surgery** → Removal of primary tumour + adjacent lymph nodes
- **Salvage Surgery** → Extensive (e.g. amputation)
- **Palliative / Hospice care** → Comfort & symptom relief in terminal cases

2. Radiation Therapy (RT)

Definition: Use of **ionizing radiation** to damage DNA & inhibit cancer cell growth.

→ **Primary treatment for many cancers**

Types

Type	Details	Examples
External RT (Teletherapy)	Source outside body	Machines: Betatron, Linear accelerator, **Cobalt-60 (most common)**
Internal RT (Brachytherapy)	Radioactive isotopes placed **inside/near tumour**	Cervical cancer
Unsealed Source	Oral/IV administration of isotopes	Thyroid cancer (I-131)
Sealed Source	Sealed container in cavity/tissue	Intracavity or interstitial therapy

Special Note:

- If isotope expelled → handle with **long forceps**, place in **lead container**, inform HCP, keep patient still.

Side Effects of RT

- Nausea, vomiting, diarrhea
- Bleeding tendencies
- Alopecia
- **Bone marrow suppression**
- **Sore throat** (neck RT)

Radiation Dose:

- Unit = **Gray (Gy)** (1 Gy = 100 rad)
- Given in **divided doses** to minimize side effects

Radiation Safety Principles

3 Key Rules (for nurses & staff):

1. **Time** – Limit exposure time
2. **Distance** – Maintain ≥**6–20 feet** if possible
3. **Shielding** – Use **lead apron / shields**

Nursing Care During RT

- **Do not wash off tumour area markings**
- Keep skin **clean & dry** (no lotions, no soap scrubbing)
- Avoid shaving in radiation area
- Protect from **direct sunlight**
- HCP must wear **lead apron** during care

Nursing Booster Points

- Screening = Secondary prevention
- Confirmatory test = Biopsy
- Most common RT source = Cobalt-60
- 3 safety rules = Time, Distance, Shielding
- Side effects = N/V/D, alopecia, sore throat, marrow suppression
- Do not remove radiation marks on skin

Chemotherapy (CT)

General Principles

- **Definition**: CT kills or inhibits reproduction of **neoplastic cells** (also affects normal rapidly dividing cells).
- Used in **combination** with:
  - ✓ Surgery
  - ✓ Radiation therapy
  - ✓ Steroids & antibiotics (e.g., Bleomycin)
- **Most common route**: IV
- **Dose calculation**: Based on **BSA (Body Surface Area)** → depends on weight & height.

Cell Cycle Specificity

Group	Drugs	Action / Phase	Special Points
Cell cycle–non-specific (CCNS)	Alkylating agents, Antitumour antibiotics	Act on all phases	Affect DNA directly
Cell cycle–specific (CCS)	Antimetabolites, Vinca alkaloids, Topoisomerase inhibitors	Specific to S or M phase	Highly active during cell division

Classification of Cancer Drugs

1. **Alkylating Agents**

- **Cyclophosphamide**, Ifosfamide → **Hemorrhagic cystitis**
  - ✓ Prevention: **Hydration + MESNA**
- **Busulfan** → Pulmonary fibrosis (monitor PFT)
- **Cisplatin** → Severe **vomiting**, nephrotoxic
  - ✓ **Antidote: Sodium Thiosulfate**

2. **Antitumour Antibiotics (DNA/RNA interference)**

- **Daunorubicin, Doxorubicin → Cardiotoxicity** (monitor ECG)
- **Bleomycin → Pulmonary toxicity** (monitor PFT)
- **Mitomycin, Dactinomycin, Valrubicin**

3. **Antimetabolites (S-phase)**
- **Methotrexate** → DOC for ectopic pregnancy, rheumatoid arthritis, hydatidiform mole
  - ✓ Side effects: **Hepatotoxic, photosensitivity**
  - ✓ **Antidote: Leucovorin (Folinic acid rescue)**
- **Cytarabine** → Cerebellar toxicity → Ataxia, slurred speech, nystagmus
- **5-Fluorouracil (5-FU)** → Cerebellar toxicity, **Hand–foot syndrome**
- **6-Mercaptopurine** → Hepatotoxic, **Hyperuricemia**

4. **M-phase Inhibitors (Mitotic Arrest)**
- **Vincristine, Vinblastine**
  - ✓ Side effects: Peripheral neuropathy, ptosis, nephrotoxicity
  - ✓ **Antidote: Hyaluronidase**

5. **Topoisomerase Inhibitors**
- **Etoposide, Teniposide, Topotecan**
- Cause: **Bone marrow suppression**

6. **Hormonal & Enzyme Therapy**
- **Tamoxifen (Estrogen antagonist)** → Breast cancer
  - ✓ Side effects: Hypercalcemia, ↑ cholesterol & triglycerides, edema
- **Corticosteroids (Prednisolone, Dexamethasone)** → Lymphoid cancers, supportive therapy

Common Side Effects of CT

1. **Bone marrow suppression (most common, dose-limiting)**
   - ✓ ↓ WBC → Infection risk
   - ✓ ↓ RBC → Anemia
   - ✓ ↓ Platelets → Bleeding
   - ✓ **Platelet <50,000 → Major bleeding risk**
   - ✓ **Platelet <20,000 → Spontaneous bleeding → Need transfusion**
2. **GI symptoms** → Nausea, vomiting, diarrhea
   - ✓ **DOC: Ondansetron** (5-HT_3 blocker, antiemetic)
3. **Alopecia** → Begins ~2 weeks, regrows in 5–6 months
4. **Gonadal effects** → Infertility (often irreversible)
5. **Hyperuricemia** → From tumour cell lysis → **Allopurinol** (Xanthine oxidase inhibitor), low purine diet
6. **Phlebitis / Extravasation** → Tissue necrosis risk
   - ✓ Do not use same vein repeatedly
   - ✓ Report necrosis to HCP immediately
7. **Anaphylaxis** (esp. with L-asparaginase, taxanes)
   - ✓ Precautions: Test dose, resuscitation equipment ready
   - ✓ Symptoms: Dyspnea, tachycardia, hypotension, cyanosis, anxiety

Nursing Interventions in Chemotherapy
- **Infection Prevention**: Neutropenic precautions, avoid crowds, no live vaccines
- **Bleeding Precautions**: Avoid IM injections, aspirin, invasive procedures
- **Monitor labs**: CBC, LFT, RFT, PFT, ECG
- **Hydration**: To prevent nephrotoxicity & cystitis
- **Use protective equipment**: Nitrile gloves, biosafety cabinet for drug prep
- **Protect skin**: From sunlight, no lotions/soaps on marked areas
- **Emotional support**: For alopecia & body image issues

Nursing Booster Points
- **Gold standard confirmatory diagnosis of cancer** → Biopsy

- **Most common route of CT** → IV
- **DOC for ectopic pregnancy** → Methotrexate
- **DOC for CT-induced vomiting** → Ondansetron
- **DOC for hyperuricemia in CT** → Allopurinol
- **DOC to prevent hemorrhagic cystitis** → MESNA
- **Antidote for Cisplatin** → Sodium Thiosulfate
- **Antidote for Methotrexate toxicity** → Leucovorin (Folinic acid)
- **Antidote for Vincristine extravasation** → Hyaluronidase

Bone Marrow Transplantation (BMT)

- **BMT / Peripheral Blood Stem Cell Transplantation (PBSCT)**:
- Procedure that **replaces stem cells destroyed** by **high-dose chemotherapy or radiation therapy**.

Indications (Uses)

- **Leukemia** (most common)
- **Lymphoma**
- **Multiple Myeloma**
- **Neuroblastoma**
- **Aplastic Anemia**
- **Thalassemia**

Types of Donor Stem Cells

Type	Source	Key Point
Allogeneic	From sibling / parent / unrelated matched donor	Risk of GVHD (Graft vs Host Disease)
Syngeneic	From **identical twin**	No GVHD
Autologous	From client's own stem cells	**Most common** Stem cells harvested in remission → frozen → reinfused later

Stem cell collection: Done by **apheresis / leukapheresis** (4–6 hrs process).

Bone Marrow Aspiration

- **Adults** → Posterior iliac crest (most common)
- **Children** → Tibia
- **Amount** aspirated → **600–2500 ml**
- **Complications** → Pain, bruising, bleeding, infection

Storage

- **Autologous**: Frozen at **–140°C** to **–196°C** (cryopreservation)
- **Allogeneic**: Transfused immediately

Procedure (Transplantation)

- Stem cells given via **IV infusion through central line** (like blood transfusion)
- **Pre & Post hydration**: IV fluids + Sodium bicarbonate
  - ✓ Purpose: Maintain renal perfusion & alkalinize urine (prevent hemolysis complications)
- **Initial 12 hrs urine** may appear **red** due to intravascular RBC lysis

Nursing Role in BMT

- Monitor for **bleeding & infection** (low WBC, platelets after high-dose chemo)
- Observe for **Graft vs Host Disease (GVHD)** in allogeneic transplant:
  - ✓ Skin rash
  - ✓ Hepatic dysfunction (↑ LFTs)
  - ✓ GI: diarrhea, abdominal pain

- Provide **protective isolation** (neutropenic precautions)
- Administer **immunosuppressants** (e.g., Cyclosporine) to prevent GVHD
- Provide **emotional & psychosocial support**

Nursing Booster Points

- **Most common indication** → Leukemia
- **Most common type of transplant** → Autologous
- **Bone marrow aspiration site**:
  - ✓ Adult → Posterior iliac crest
  - ✓ Child → Tibia
- **Storage temperature** → −140°C to −196°C
- **Red urine after BMT** → Due to intravascular hemolysis
- **Allogeneic transplant complication** → GVHD

Engraftment & Complications of Bone Marrow Transplant (BMT)

- **Definition**: Process by which **transfused stem cells migrate** to bone marrow sites and begin **producing new WBCs, RBCs, and platelets**.
- **Timeline**: Occurs in **2–5 weeks** after transplantation.
- **Major Concerns (before engraftment)**:
  - ✓ **Infection** (low WBC → neutropenia)
  - ✓ **Bleeding** (low platelets → thrombocytopenia)

Complications of BMT

Complication	Seen In	Key Features	Nursing Care / Management
1. Failure to engraft	Any type	No recovery of blood counts	Repeat transplantation may be needed
2. GVHD (Graft vs Host Disease)	**Allogeneic transplant**	Donor T-cells attack host tissue → Rash, diarrhea, hepatitis	Immunosuppressants (e.g., Cyclosporine, Methotrexate, Corticosteroids)
3. Veno-occlusive disease (VOD)	Post BMT (esp. after chemo/RT)	Obstruction of hepatic venules → Thrombosis / phlebitis	**Symptoms:** RUQ abdominal pain, hepatomegaly, jaundice, weight gain, ascites

Nursing Booster Points

- **Engraftment success** → Rise in **WBC, RBC, Platelets**
- **Time for engraftment** → **2–5 weeks**
- **Pre-engraftment risk** → Infection & bleeding
- **GVHD** → Seen in **allogeneic** BMT (not in autologous or syngeneic)
- **VOD hallmark** → RUQ pain + hepatomegaly + weight gain

Tumours (Cancers) of Different Body Organs

Skin Cancer

(Malignant lesion of the skin – may or may not metastasize)

Causes / Risk Factors

- **Overexposure to sunlight (UV radiation)** → most common cause
- Chronic skin damage
- Repeated injury or irritation
- Fair skin, family history
- Immunosuppression

Types of Skin Cancer

Type	Origin	Features	Metastasis
Basal Cell Carcinoma (BCC)	Basal cells of epidermis	Waxy papule with rolled border, central crater, red surface	Rare
Squamous Cell Carcinoma (SCC)	Epidermal keratinizing cells (keratinocytes)	Oozing, bleeding, crusted lesions, may ulcerate	Can metastasize to lymph nodes
Melanoma	Pigment-producing melanocytes (moles, birthmarks)	Irregular, circular border, black/blue lesion, rapid infiltration	**Highly malignant** → spreads to brain, lungs, bone, liver

Clinical Manifestations (C/M)

- Change in **colour, size, or shape** of existing lesion/mole
- Pruritis (itching)
- Local soreness or non-healing ulcer

Diagnosis

- **Confirmatory test → Skin Biopsy**

Interventions / Management

- **Health Education / Prevention**
  - ✓ Perform **monthly self-skin exam**
  - ✓ Report non-healing lesions or changing moles
  - ✓ Avoid sun exposure (esp. **10 AM–4 PM**)
  - ✓ Use sunscreen (SPF ≥30) & protective clothing
- **Treatment**
  - ✓ **Cryosurgery** (freezing lesion)
  - ✓ **Curettage** (scraping)
  - ✓ **Electrodesiccation** (burning)
  - ✓ **Surgical excision** (preferred for melanoma)

Nursing Booster Points

- **Confirmatory diagnosis** → Skin biopsy
- **Most common skin cancer** → Basal cell carcinoma
- **Most malignant skin cancer** → Melanoma
- **Metastasis in SCC** → Lymph nodes
- **Metastasis in Melanoma** → Brain, lungs, bone, liver

Leukemia

- Leukemia = **Group of hematological malignancies** with abnormal **overproduction of immature WBCs (blast cells)** in **bone marrow**.
- Leads to: ↓ RBCs, ↓ Platelets, ↓ mature WBCs → **Pancytopenia**.

Causes

- Radiation exposure
- Genetic factors
- Immunosuppression

Types of Leukemia

Type	Cell Type	Age / Onset	Key Notes
AML (Acute Myeloblastic Leukemia)	Myeloblasts	Age 15–39 yrs	Common in young adults
CML (Chronic Myeloblastic Leukemia)	Granulocytes	30–40 yrs (4th decade)	Most common in adults
ALL (Acute Lymphoblastic Leukemia)	Lymphoblasts	**Most common cancer in children**	Good prognosis with chemo
CLL (Chronic Lymphoblastic Leukemia)	Mature lymphocytes	>50 yrs	Common in elderly

Clinical Manifestations (C/M)

- General: **Anorexia, fatigue, weakness**
- Frequent infections: URI, common cold, cough
- **Pancytopenia** = Anemia + Thrombocytopenia (bleeding) + Leukopenia (infection)
- ↑ **Blast cells**, ↓ mature cells
- Organomegaly: Enlarged **liver, spleen, lymph nodes**
- Enlarged **frontal bones** (due to marrow expansion)

Q. Nadir = Period of **greatest bone marrow suppression** when WBC count is extremely low

Diagnosis

- **Bone Marrow Biopsy** → Confirmatory test
- Shows **blast cells** (immature leukemic cells)

Management

- **Chemotherapy** → often at **Day Care Centre (DCC)**
- Supportive care → blood transfusion, antibiotics, stem cell transplant (if needed)

Nursing Priorities

1. Prevent Infection (Top Priority)

- Protective isolation (neutropenic precautions)
- Keep door closed, restrict visitors, avoid crowds
- Avoid fresh flowers, raw fruits/vegetables
- **Live vaccines contraindicated**

2. Prevent Bleeding

- Avoid rectal suppositories/enemas
- Avoid NSAIDs & aspirin
- Monitor for petechiae, bruising, bleeding gums
- Transfuse platelets if <20,000/mm³

3. Nutrition

- High calorie, high protein, high carbohydrate diet
- Small frequent meals

Nursing Booster Points

- **Most common leukemia in children → ALL**
- **Most common in adults → CML**
- **Confirmatory diagnosis → Bone marrow biopsy** (blast cells)
- **Nadir** → Lowest WBC count (greatest marrow suppression)
- **Main priority care** → Prevent infection

Lymphomas

- **Lymphoma** = Malignancy of **lymphocytes** (lymph cells) involving **lymph nodes, spleen, tonsils, bone marrow**.
- Two main types:
  1. **Hodgkin's Lymphoma (HL)**
  2. **Non-Hodgkin's Lymphoma (NHL)**

Hodgkin's Lymphoma

- **Origin**: Single lymph node or chain of nodes → spreads orderly
- **Hallmark**: Presence of **Reed–Sternberg (RS) cell** on biopsy.
- **Confirmatory diagnosis**: **Biopsy** (specimen preserved in **10% formalin**).

Clinical Manifestations

- **Painless cervical lymphadenopathy** (most common initial sign)
- Later: Involvement of **liver & spleen** (hepatosplenomegaly)
- B-symptoms (systemic signs):
  - ✓ Fever
  - ✓ Night sweats
  - ✓ Weight loss

Non-Hodgkin's Lymphoma

- **Origin**: Multiple lymph nodes, diffuse pattern, can spread extranodally (GI tract, CNS, bone marrow).
- **No Reed–Sternberg cells**.
- More aggressive than HL.

Staging (Ann Arbor Staging – HL)

- **Stage I** → Single lymph node region
- **Stage II** → ≥2 lymph node regions on same side of diaphragm
- **Stage III** → Lymph nodes on both sides of diaphragm
- **Stage IV** → Diffuse involvement (liver, bone marrow, etc.)

Management

- **Early stage (I & II without mediastinal node involvement) → Radiation therapy** (local external beam)
- **Advanced stage (III & IV or extensive disease) → Chemotherapy + Radiation therapy (combined)**
- **Infection & bleeding precautions** (due to bone marrow suppression from treatment)

Nursing Booster Points

- **HL hallmark** = Reed–Sternberg cell (owl's eye appearance)
- **NHL** = No RS cell, more widespread at diagnosis
- **Specimen preservative** for biopsy → **10% formalin**
- **Most common initial sign HL** = Painless cervical lymph node swelling
- **B-symptoms** = Fever, night sweats, weight loss
- **HL spreads orderly** → single → contiguous nodes
- **NHL spreads non-contiguously** → multiple, extranodal
- **CML (Chronic Myelogenous Leukemia)** is linked with **Philadelphia chromosome** (translocation t(9;22)).

Multiple Myeloma

- **Malignant proliferation of plasma cells** within the bone marrow.
- Excessive plasma cells **destroy bone** and produce **abnormal antibodies** (*Myeloma protein / Bence-Jones protein*).

Pathophysiology
- ↓ Normal **Immunoglobulins (Ig) & Antibodies** → Immunosuppression
- ↑ **Uric acid** → Gout, renal damage
- ↑ **Calcium (Hypercalcemia)** → Bone pain, fractures, renal calculi
- **Bence-Jones protein** present in **blood & urine** → diagnostic clue
- Progressive **bone marrow failure** → ↓ RBCs, WBCs, Platelets

Clinical Manifestations (C/M)
- **Bone pain** → ribs, spine, pelvis (most common)
- **Osteoporosis** & pathological fractures
- **Pancytopenia** → anemia, infection, bleeding tendency
- **Renal failure** (due to proteinuria, hyperuricemia, hypercalcemia)

Diagnosis
- **Bone marrow biopsy** → confirms plasma cell infiltration
- **Bence-Jones protein** detection in urine
- Serum electrophoresis → Monoclonal antibody spike (M protein)

Complications
- **Pathological fractures**
- **Spinal cord compression**
- **Kidney failure** (due to hypercalcemia + uric acid crystals)

Management
1. **Chemotherapy** – Primary treatment
2. **Symptomatic / Supportive therapy**
   - ✓ Encourage **≥2 L/day fluids** (prevent renal damage)
   - ✓ **Bisphosphonates** → Reduce bone pain, fracture risk, and hypercalcemia
   - ✓ Analgesics for pain
3. **Monitor**:
   - ✓ Renal function (creatinine, urine output)
   - ✓ Calcium, uric acid levels
4. **Nursing care**:
   - ✓ Provide skeletal support (braces, positioning)
   - ✓ Provide **hazard-free environment** (fall & fracture prevention)

Nursing Booster Points
- **Abnormal antibody in MM** → Myeloma protein / Bence-Jones protein
- **Confirmatory test** → Bone marrow biopsy
- **Most common symptom** → Bone pain (spine, ribs, pelvis)
- **Major complication** → Pathological fractures + Renal failure
- **Best supportive drug** → Bisphosphonates
- **Fluid intake** → ≥2 L/day

Oral Cancer
- **Malignant tumour of oral cavity**, most commonly **Squamous Cell Carcinoma**.
- Predominantly seen in **males**, strongly associated with **tobacco use**.

Etiology (Causes / Risk Factors)
- **Tobacco chewing (most common)**
- Smoking
- Excessive hot & spicy foods
- Chronic irritation (ill-fitted dentures, poor oral hygiene)
- Alcohol use
- Viral infections (HPV)

Stages / Precancerous Lesions

1. **Submucous Fibrosis** → Fibrous deposits in oral mucosa
2. **Leukoplakia** → White patch, non-scrapable (premalignant)
3. **Oral Cancer** → Malignant transformation

Common Sites

- **Lower lip** (tobacco users)
- **Tongue** (most dangerous, poor prognosis)
- Cheek (buccal mucosa)
- Floor of mouth

Clinical Manifestations (C/M)

- **Non-healing sore / ulcer** in mouth
- Dysphagia (difficulty swallowing)
- Trismus (difficulty opening mouth)
- Slurred speech
- Pain in advanced stages
- Enlarged cervical lymph nodes (metastasis)

Diagnosis

- **Inspection** → Visible non-healing ulcer / lesion
- **Confirmatory test → Biopsy**

Management

- **Radiotherapy** / **Chemotherapy** (depending on stage & spread)
- **Surgery**:
  - ✓ **Glossectomy** → removal of tongue (part/whole)
  - ✓ **Mandibulectomy** → removal of jaw (partial/complete)

Prognosis

- **Tongue cancer → Poor prognosis** (highly aggressive & metastatic)

Nursing Booster Points

- **Most common cause of oral cancer** → Tobacco chewing
- **Most common precancerous lesion** → Leukoplakia
- **Most common site** → Lower lip
- **Poor prognosis site** → Tongue
- **Confirmatory diagnosis** → Biopsy

Laryngeal Cancer

- **Malignant tumour of the larynx**
- Most commonly **Squamous Cell Carcinoma**

Etiology / Risk Factors

- **Cigarette smoking (most common)**
- Chronic laryngitis
- Overuse of voice (teachers, singers)
- GERD (acid reflux)
- Prior radiation exposure

Clinical Manifestations (C/M)

- **Early sign → Persistent hoarseness of voice** (most important)
- Voice changes
- Chronic cough

- Feeling of **lump in throat**
- Dysphagia
- **Late sign** → Haemoptysis

Diagnosis
- **Laryngoscopy** → visualization of lesion
- **Biopsy** → confirmatory

Management
1. **Radiation Therapy (RT)** → If confined to one vocal cord
2. **Chemotherapy (CT) + RT** → For advanced stages
3. **Surgery**:
   - ✓ **Partial laryngectomy** → preserves some voice
   - ✓ **Total laryngectomy** → complete removal → **Aphonia**
   - ✓ Often requires **tracheostomy** for airway

Post-Operative Nursing Care
- **Airway management**:
  - ✓ Tracheostomy → provide **humidified & moist air**
  - ✓ Suction as needed, prevent infection
- **Position** → Fowler's (↑ airway expansion)
- **Monitor respiratory status** (O_2 sat, breath sounds)
- **Nutrition**: NG tube initially, later speech therapy for swallowing
- **Communication support**:
  - ✓ Teach **esophageal speech** or provide **voice prosthesis**
- **Psychological support** for loss of natural voice

Nursing Booster Points
- **Most common cause** → Smoking
- **Early sign** → Persistent hoarseness of voice
- **Confirmatory diagnosis** → Biopsy
- **Complication of total laryngectomy** → Aphonia
- **Airway care post-surgery** → Tracheostomy with humidified air

Esophageal Cancer
- **Malignancy of esophageal mucosa**
- Histological types:
  - ✓ **Squamous Cell Carcinoma**
  - ✓ **Adenocarcinoma**

Risk Factors
- Family history
- Cigarette smoking
- Alcohol consumption
- Tobacco chewing
- **GERD / Chronic esophagitis** (spicy/hot foods)
- Barrett's esophagus (precancerous condition → adenocarcinoma)

Common Site
- **Lower third of esophagus** (most common)

Clinical Manifestations (C/M)
- **Dysphagia** → initially solids → semisolids → liquids
- **Odynophagia** (painful swallowing)