

ONCOLOGY

- 2nd leading cause of deaths in the US
- Men: Lung, prostate, colorectal
- Women: Lung, breast, colorectal
- 80% diagnosed >55 years old

Pathophysiology of Cancer:

- Genetic mutation of DNA
- Inherited or **acquired** (most common)
- Leads to -> Invasion (tumor) and Metastasis via blood and lymph

Tumor: Benign or Malignant

- Benign: well differentiated, slow and encapsulated
- Malignant: dysplasia, rapid & invasive,

Carcinogenesis: three step process

- Initiation: DNA mutation, Permanent genetic damage
- Promotion: Repeated exposure, Clonal expansion, Reversible (unless)
- Progression: Increased malignancy, Angiogenesis, Invasion & metastasis

Proto-oncogenes: stimulate cell growth

- EGFR, KRAS, c-Myc
- KRAS mutation: Pancreatic, Lung, Colorectal cancer

On and off switch

Virus

- 10-12% of cancers
- DNA affecting directly by integrating to the DNA host
- HPV -> cervical, head & neck
- HBV -> Liver cancer
- EBV -> Burkitt lymphoma
- Loss of growth control

Bacteria

- Indirect role via: chronic inflammation, carcinogenic metabolites
- H. Pylori -> gastric cancer
- Salmonella -> colon cancer
- Chlamydia -> cervical/ovarian cancer

Physical

- UV radiation -> skin cancer
- Ionizing radiation -> low risk
- Radon exposure -> lung cancer
- Occupational: asbestos, industrial chemicals, charred meat, Benzene, etc

Chemical

Tobacco -> leading preventable cause: Responsible for ~30% of cancers DNA affecting of deaths

- Associated with 12 or more cancer types

ENDS

- Contain nicotine, volatile organic compounds
- Long-term effects unknown
- NOT SAFE ALTERNATIVES

Lifestyle Factors & Cancer Risk

- Contribute to ~16% of cancers cases
- Obesity, alcohol, smoking, poor diet, physical inactivity processed meats, alcohol, high fat intake
- **Obesity**: breast, colon, endometrial, pancreatic
- Chronic inflammation, Hormonal imbalance, Growth factor dysregulation

Hormonal factors

- Breast, prostate, ovarian, endometrial
- Early menarche, late menopause, nulliparity, hormone replacement therapy
- Combination estrogen-progesterone -> INCREASE breast cancer risk

Immune system in Cancer

- Cancer survivors are immunocompromised

TAA (tumor associated antigens)

- recognized by antigen-presenting cells (APC)
- Macrophages and dendritic cells

APC activate T and B lymphocytes

Immune Destruction of Cancer cells

Activated T lymphocytes

Recruit Cytokines

Coordinated immune response limits tumor growth

Tumor express PD-1 ligands

Bind PD-1 receptors on T cells

-> ineffective T cells

Foundation for checkpoint inhibitory therapy

Altered Immunogenicity

Reduce antigen expression

Mask tumor antigens

Hide cancer cells

Suppress further immune response

T-cell imbalance in Cancer

Increase suppressor (regulatory) T cells

Cancer is highly dependent on immune system

Poor immune = high chance of cancer

Basis for: [Immunotherapy](#), [cancer vaccines](#), [checkpoint inhibitors](#)

PRIMARY PREVENTION

- Lifestyle modification
- Health promotion
- Environmental risk reduction
- Immunization

SECONDARY prevention (Early detection)

RISK FOR CANCER

- Gender, age, genetic predisposition

Cancer screening programs:

- Mammography at least TWICE a year (breast)
- Digital rectal exam (prostate)

BRCA syndrome (high risk for breast cancer)

TERTIARY Prevention (Survivorship Care)

- Prevent recurrence and complication
- Prevent relapse
- cancer therapy can induce cancer
- Yearly do follow-up
- Remove the organ (last resort)
- LIFE-LONG FOLLOW UPS

Diagnosis of Cancer

Biopsy (MAIN DIAGNOSTIC)

- Extent and metastasis

Physical exam, imaging, lab test, pathologic tissue analysis (aspirations)

TNM staging

size: T0-T4

Tis: not invading other organs

Lymph nodes: N0-N3

increasing nodal involvement

Metastasis: M0-no distant spread

M1: distant metastasis

Anatomic Stage Grouping

Stage 1: localized,

Stage 2 - Stage 3: Regional spread, nodal involvement

Stage 4: distant metastasis

Tumor grading

Grade 1: well differentiated

Grade 4: poorly differentiated

ONLY Screening test DOES NOT DICTATE diagnosis itself

find table in book about test that may indicate the cancer

EFGR -> epidermal cancer

CRAS -> Colon and pancreatic

BRCA -> breast cancer

BRAF -> Melanoma

Glyco proteins -> ovarian (CA125), (CA153) breast cancer, (?)

CAUTION US

- Change in bowel/bladder
- A soar that does not heal
- Unexplained anemia
- T lump or mass
- Indigestion
- Obvious change in warts or mole
- N cough
- Unexplained weight loss
- Sudden weight loss

+ DO CT test

AFTER do Biopsy

NOT ALL tumors can be removed

- Identify if tumor is ENCAPTULATED = REMOVAL
- IF NOT, malignant cells will metastasis

REMOVE if it causes organ suppression

AFTER BIOPSY -> staging and grading

Excisional biopsy (therapeutic and diagnostic)

- ENTIRE tumor
- BEST diagnostic accuracy

Incisional

- PORTION of tumor

Needle Biopsy

- Fine-needle aspiration
- core-needle (tissue sample)

Sentinel lymph node Biopsy

- Minimally invasive
- Reduce lymphedema, and delayed wound healing
- Breast cancer, melanoma

CANCER MANAGEMENT

Either CURE, CONTROL, PALLIATION

Cure: COMPLETE eradication

Control: PROLONG survival

Palliation: Relief and quality of life

MAJORITY of cancer is hospice and palliation

Treatments:

Surgery

- **FIRST** line treatment
- Tumor; surrounding tissue, regional lymph nodes (can lead to disfigurement)
- Curative, diagnostic, palliative, prophylactic, reconstructive

LOCAL EXCISION

- Tumor + small margin of normal tissue
- Outpatient
- For small, accessible tumors
- Wide / Radical excision (**En Bloc**)
 - Higher RISK for disfigurement and functional impairment

MINIMALLY INVASIVE CANCER SURGERY

- Less trauma, blood loss, risk for infection

ENDOSCOPIC SURGERY

- USE of camera
- 1-2 cm incisions
- Common in thoracic and abdominal

ROBOTIC-ASSISTED SURGERY

- Enhance laparoscopic surgery

SALVAGE SURGERY

- IF initial minimal surgery DOES NOT work
- Local recurrence

LOCAL TUMOR DESTRUCTION TECHNIQUE

- **Cryoablation:** freeze or increase temp to kill the tumor

Lasers:

- Electrosurgery: electrical signal to destroy tissue
- Photodynamic: USE of light

Radiofrequency ablation (RFA): LESS injury

Chemosurgery: DIRECT chemo drugs to tumor

PROHYLACTIC

- Remove of Nonvital organs at high cancer RISK
- AFTER, DO Reconstructive surgery IF needed to RESTORE function or Body image

Radiation therapy

- Used in ~60% cancer patients
- USE to cure or treat cancer
- **Neoadjuvant** = before a treatment
- **adjuvant** = supplementary
- USES ionizing radiation, produce radical metabolites -> cell death
- Effect is **LOCALIZED**
- EFFECTIVE for **RAPIDLY** dividing, **POORLY** differentiated
- **Most sensitive tissues:** bone marrow, GI epithelium, skin, hair follicles
- Divide dose into a daily fraction -> normal tissue repair, **INCREASED** tumor cell kill
 - New techniques: Hypofractionation, SBRT
 - Hypoxic -> less resistant to radiation

External Beam Radiation Therapy:

- Linear accelerators, GammaKnife
- Targets tumor -> tumor shrink

Specialized EBRT:

- SBRT: 1-5 treatment, high dose
- Photon Therapy: minimal exit dose, protect **CRITICAL** organs

Internal Radiation (Brachytherapy)

- High dose specific to the target area
- **Temporary:** HDR and LDR
- **Permanent:** Seeds or Needles
- Patient is radioactive, all things will also be radioactive, **WASTE PRODUCTS**
- **PAINFUL**
- **Safety:** Private room (walls should be LED), Dosimeter badges, No pregnant, Visitor time limits

Systemic Radiotherapy:

- Oral or IV
- I-131 therapy for thyroid cancer
- Radium-223 for prostate bone metastases
- Radioimmunotherapy for lymphoma

RADIATION TOXICITY

Acute: Radiodermatitis, Mucositis, bone marrow suppression, Fatigue

Late: Fibrosis, Atrophy, Organ dysfunction, Sexual and Cognitive changes

(memory loss, concentrate problems)

RADIATION SAFETY

- TDS: time, distance (**AT LEAST 6 FEET**), shielding (**PPE**)
- Patient education to **REDUCE** anxiety
- **ORANGE WASTE BIN FOR RADIOACTIVE**

Chemotherapy

- TWO main functions: **ALTER DNA** synthesis -> death, affects cell cycle process
- **ALL RAPID DIVIDING CELLS** (log-kill hypothesis)

-> rapid: skin, mucosal, endothelial

-> non-rapid : Liver, brain

20-99% of tumor cells

Cell cycle:

Growth/Gap 1 or G1: RNA and protein synthesis

CHECKPOINT: at the end of G1 -> IF NOT approved -> state G0 (cell is not capable of reproduction; if damage cannot be reversed -> apoptosis)

S: DNA synthesis (pairs divide by 2)

G2: Each organelle while divide; Premitotic phase

Another CHECKPOINT: Check if DNA replicated is correct, if incorrect -> apoptosis

M: PMAT (Prophase, metaphase, anaphase, telophase)

Cancer can EVADE the checkpoints

Effects vary per phase

CLASSIFICATIONS: PAG ARALAN MO DEFINITIONS NITO

Alkylating agents:

- **Busulfan**
- Not SPECIFIC in the cell cycle
- **Cisplatin** = renal toxicity

Nitrosoureas

Topoisomerase I inhibitors (-tecan)

Topoisomerase II inhibitors (-toside)

Antimetabolites

- Bone marrow destruction
- **Methotrexate** (neuropathy)

Antitumor antibiotics

- **-bicin (doxorubicin)** -> cardio toxic
- **-mycin (Bleomycin)** -> pulmonary toxic

Mitotic spindle inhibitors (Plant alkaloids)

- M phase
- **Vincristine** (neuropathy) **Vinblastine** (bone marrow suppression)

Mitotic Spindle inhibitors (Taxanes)

- **-Axtel** -> peripheral issues

Hormonal agents

- Suppression of hormone dependent tumor growth
 - -> hot flushes, feminization (estrogen)
 - -> vaginal dryness (androgen)

CANCER BEAR

- Doxorubicin - cardio toxic -> ejection fraction (2D echo)
- 4 C's (ears and kidney) - nephro
- M - nephro and hepato and bone marrow
- V (extremities) - bone marrow suppression
- CY (cyclophosphamide) - bladder

Combination therapy

- Uses agents with different mechanisms and toxicities
- INCREASES REACH of chemo, and LOWER doses -> less side effects

Adjunct chemotherapy

- ENHANCE OR LOWER effects/side effects
- **Leucovorin** -> DECREASE bone marrow and GI toxicity
 - -> ENHANCES **fluorouracil**

ROUTES

- IV (MOST COMMON)
- Oral, SQ, Intrathecal (spinal cord), Intraperitoneal, Intra-arterial
- Depends on Drug, Dose, Cancer Location

NO MEDICATION SHOULD BE GIVEN TO INTRA-ARTERIAL UNLESS CHEMO SITUATIONS

SAFETY STANDARDS

- ONS, ASCO (governed by)
- Specialized training
- Safe handling (Laminar flow of air due to meds fumes in aspiration)
- Patient Education

EXTRAVASATION if Vesicants

- Vesicants -> severe tissue necrosis
- Hand swollen, painful, TRY to aspirate as much as you can
- Irritants -> inflammations -> phlebitis
- **DO NOT USE** veins at the back of hands (rupture) wrist or cephalic veins (mobile issues)
- Vein should be stable (peripheral or bolar area)

- USE of veins finder (illuminants) DOES NOT show how DEEP
- RECOMMENDED that highly trained IV insertions for chemo
- ER nurses, [sharp-shooters]
- Px should have Central Line (only 2 weeks IJ) should be **IMPLANTABLE** central line
- Catheter end of vena cava (**Porta-cath**)
- CHECK if patent before medication

ANTIDOTES

- Hypersensitivity Reactions (HSRs)
 - Allergy (IgE), cytokine release (non-IgE)
 - **IMMEDIATELY STOP**

General Chemo Toxicities

- GI: Chemo induced nausea and vomiting (CINV), stomatitis (singaw)
 - Diarrhea and anorexia
 - Hair follicles: 3 weeks in, alopecia
 - Asospermia
 - Bone marrow -> LAHAT NG PENIA
- Acute: DURING CHEMO
- Chronic: long-term
- Dose-limiting: happens IF DOSE IS HIGH

CHEMO BRAIN

- Memory loss, poor concentration, executive dysfunction
- Cancer-related fatigue -> aerobic exercise (BREATHING)

LONG TERM COMPLICATIONS

- Cardio disease, pulmonary toxicity, infertility (ASK IF THEY WANT TO HAVE A CHILD -> Sperm banking or cryogenic egg), Osteoporosis, Immune dysfunction, 2nd malignancy, endocrine disorders, sensory and neurologic changes

SPILL IT area -> antidotes for chemotherapeutic agents

- Alka-acid = acid-alka
- Emergency SHOWERS
- **IMMEDIATELY REPORT** spillages
- Proper disposal, SPILL PROOF containers is a MUST

Immunotherapy

- New Treatment for Cancer
 - IMPROVE the immune system
- Immunotherapy REVERSES these
 - Cancer can produce cytokines to inactivate antigen presenting cells
 - PP1 Ligand -> stops T cells

NON-SPECIFIC IMMUNO

- **BCG** (bladder cancer)
- IFN-IL2 (cytokines)
 - -> Flu-like symptoms

MONOCLONAL ANTIBODIES

- SPECIFIC tumor antigen
- Toxicities: Hepato, HTN

IMMUNE CHECKPOINT INHIBITORS

- Remove immune system “brakes”
- Targets: CTLA-4, PD-1, PD-L1

CANCER VACCINES

- Example. Hepa B & C
- Sipuleucel-T (prostate cancer)
- DOES NOT CURE

CAR T-Cell

- SPECIFIC antigen (CD19)
- Toxicities: Cytokine release syndrome (CRS) -> FEVER (hallmark), hypotension, hypoxia
- Neurologic toxicities

Targeted therapy

- **DEREGULATED** signaling pathways
- Abnormal preceptors and proteins driven: tumor, survival, metastasis
- Molecular based therapies

TYROSINE KINASE INHIBITORS (TKI)

- BLOCK
- Imatinib
- INDICATIONS: CML, ALL, GI stromal tumor

EGFR INHIBITORS

- Non-small cell lung cancer

PROTEASOME INHIBITORS

- Bortezomib
- Multiple myeloma

COMMON TOXICITIES

- Myelosuppressions
- Similar to others

HSCT

- USED for Blood Cancers
- Apheresis: get blood and filter for stem cells
- Donor - allogenic
- px - autonomous
- Twin - syngeneic

NURSING CARE

- Monitor vitals, oxygen, adverse reaction
- Can cause nausea, diarrhea
- AT RISK for Sepsis, Bleeding
- REVERSE ISOLATION px -> Positive air flow
- BOTH wear PPE
- ASSESS for tumor lysis syndrome (Hyperkalemia)
- Graft-versus-host disease (Rejection of transplant; hypotension, bradycardia, severe allergic reactions)
- Pulmonary and Renal complications
- HSCT complications

COMMON PROBLEMS

Infections and neutropenia

Stomatitis (oral mucositis)

- Difficult to chew, swallow, talk
- 3-14 days AFTER treatment
- Chemo (doxorubicin, 5-FU), Radiation, Immunotherapy, targeted therapy
- Meticulous oral hygiene (Soft bristle toothbrush, gargle (no alcohol mouthwash, chlorhexidene, warm water with salt)
- Enteral feeding if cannot oral feed
- TPN INCREASES RISK for infection

Radiation-associated skin infection

- Erythema, Pruritus, dry or wet desquamation
- To muscle (Grade 4)
- Pain and LOWER quality of life
- Gentle skin cleansing (NO highly alkaline), Moisturizers (non-irritating)
- AVOID sun exposure, tape/bandages, friction
- PREVENT infection and trauma

Alopecia

- Destruction of hair follicles
- Chemo, radiation, targeted
- Onset: Chemo (1-3 weeks), Targeted (1-3 months)
- Body image and self-esteem -> depression and distress
- Anticipatory guidance, wigs and head covering -> scalp cooling

Malignant skin lesions

- LOWER blood supply due to cancer cell -> necrosis -> infection -> Mal odor
- Wound care, comfort, odor management (KEEP it dry, carbon-based dressing)

PROMOTING NUTRITION

- Weight loss is common in cancer px
- CRITICAL to identify early
- malnourished -> affects healing
- Px DOES NOT want to eat because of vomiting -> Corticosteroids
- Anorexia, Malabsorption syndrome, Cachexia syndrome

- Pharmacologic:
 - Metoclopramide
 - Megestrol acetate
 - short-term corticosteroids
- Enteral feeding IF NEEDED

RELIEVING PAIN

- Cancer px are ALWAYS in pain
- OFTEN chronic
- influenced by: physical, psychological, cultural factors
- ADDRESS it proactively
- USUALLY moderate-severe pain -> OPIOIDS (side effects and toxicities)
- PCA (patient-controlled analgesia) for recurrent pain
- FOR TOLERANCE intrathecal

INFECTION RISK

- Neutropenia -> CHECK absolute neutropenic count
- SEVERE RISK = <500 (THIS IS MEDICAL EMERGENCY -> REVERSE ISOLATION -> CULTURE -> ANTIBIOTICS)

BLEEDING & THROMBOCYTOPENIA

- <100,000 - thrombocytopenia
- <50,000 high bleeding risk
- <10,000 spontaneous bleeding
- Filgastrin, eltrombopag

VENOUS THROMBOSIS

- DVT, PE
- PREVENT by stockings and pneumatic compression devices
- NO ANTICOAGULATIONS

OTHERS

- Fatigue (aerobic exercise)
- Body image (disorders or reconstructive)
- Sexuality (sperm and egg)
- Grief
- Psychosocial distress (anxiety and depression)

ONCOLOGIC EMERGENCIES

- life-threatening conditions:
 - **SVCS**: impede the vena cava
 - **Spinal cord compression**: cervical area -> no control respiratory and below -> respiratory distress
- MAY ISA PA
 - **Hypercalcemia**: COMMON side effects of chemo drugs -> cardiac arrhythmias -> dialysis
 - **Tumor Lysis Syndrome (TLS)**: rupture of the cancer cells -> **Hyperkalemia** (peaked T wave, prolonged QR, diaxilate) spontaneous or after treatment
- Rapid recognition **NEEDED**

CANCER SURVIVOR

- CONTINUOUSLY monitor
- Relapse possible

ADVANCE AND HOSPICE CARE

- Pain control, symptom relief, quality of life, peaceful death