# Medical Oncology

MARROW
Super Speciality

## Instructions

- The notes must be used in conjunction with the Marrow SS Medicine videos and should not be considered standalone material.

## Please note:

- The information in this book has been printed based on the transcript of the Marrow SS Medicine videos.
- The information contained in this book is for educational purposes only. The content provided is not intended to substitute for professional medical advice, diagnosis or treatment.
- This book cannot be sold separately. It has been made available to only select eligible users who have an active subscription to Marrow SS Medicine videos.
- The text, images, slides, and other materials used in this book have been contributed by the faculty, who are subject matter experts. We have merely reproduced them as video transcripts in this book.
- The notes have been consciously designed in a way that is concise and revisable. To ensure this, we have intentionally added only the most relevant modules and images that are needed for you.
- Reasonable care has been taken to ensure the accuracy of the information provided in this book. Neither the faculty nor Marrow takes any responsibility for any liability or damages resulting from applying the information provided in this book.
- This set contains notes of all main videos published in the app until Jan 2025. You can find notes for any additional videos published after this date within the app under the videos section.

**All Rights Reserved**

No part of this publication shall be reproduced, copied, transmitted, adapted, modified or stored in any form or by any means, electronic, photocopying, recording or otherwise.

© Marrow

//ME801SS-SAP

# Contents


## Basics of Oncology

1. Basics of Paediatric Oncology 1
2. Epidemiology and Molecular Biology of Paediatric Cancer 12
3. Central Catheters in Oncology 27

## Neuro-Oncology & Head and Neck Cancers

4. Head & Neck Cancer 31
5. Metastatic HNSCC 41
6. Oral Cavity Cancer 43
7. Nasopharyngeal Cancer 48
8. Brain Tumours : Part I 52
9. Brain Tumors : Part II 69
10. Neuroblastoma 87
11. Retinoblastoma 99

## Breast & Thoracic Oncology

12. Small Cell Lung Cancer 115
13. Mutation Driven Metastatic NSCLC 123
14. Metastatic NSCLC without Driver Mutation 133
15. Management of Non Metastatic NSCLC 140
16. Pleural Mesothelioma 146
17. Pulmonary Toxicity 151
18. Superior Vena Cava Syndrome 159
19. Thymoma and Thymic Carcinoma 165
20. Breast Cancer - Basics 170
21. DCIS 176
22. Breast Cancer - Surgery & Radiation 179
23. Metastatic Breast Cancer Management Part I 183

24. Metastatic Breast Cancer Management Part II 189
25. Systemic Treatment of Non Metastatic Breast Cancer : Part I 191
26. Systemic Treatment of Non Metastatic Breast Cancer : Part II 194
27. Breast Cancer – Miscellaneous : Part I 199
28. Breast Cancer – Miscellaneous Part II 206

## Gastrointestinal Oncology

29. Oesophageal Cancer 211
30. Liver Cancer 218
31. Hepatic Tumors in Pediatrics 232
32. Pancreatic Carcinoma 243
33. Cholangiocarcinoma 250
34. Lynch Syndrome 255
35. Familial Adenomatous Polyposis 259
36. Treatment of Carcinoma Colon 263
37. Gastrointestinal Stromal Tumors 271
38. Anal Canal Cancer 280

Update → Rectal Cancer
→ Treatment of Gastric & EGJ Cancer

## Genito-Urinary Oncology

39. Renal Cell Carcinoma : Part I 287
40. Renal Cell Carcinoma : Part II 299
41. Wilms Tumor 306
42. Urinary Bladder Cancer Part I 316
43. Urinary Bladder Cancer Part II 324
44. Testicular Germ Cell Tumors 331
45. Testicular Germ Cell Tumors Part II 341
46. Basics of Prostate Cancer 346
47. Treatment of Prostate Cancer Part I 349
48. Treatment of Prostate Cancer - II 355

## Gynecologic Malignancies


49. Endometrial Cancer 358
50. Cervical Cancer 366
51. Ovarian Cancer I 373
52. Ovarian Cancer II 381
53. PARP Inhibitors and Ovarian Cancer 383
54. Granulosa Cell Tumors 387
55. Ovarian Germ Cell Tumors 389


## Endocrine Neoplasms


56. MEN I Syndrome 391
57. MEN 2 Syndrome 399
58. Medullary Thyroid Cancer 405
59. Anaplastic Thyroid Carcinoma 412
60. Differentiated Thyroid Cancer 416


## Skin Neoplasms


61. Malignant Melanoma - Basics 427
62. Malignant Melanoma - Treatment 433


## Bone and Soft Tissue Neoplasms


63. Soft Tissue Tumors 439
64. Soft Tissue Sarcoma (Paediatrics) 448
65. Osteosarcoma 457
66. Osteosarcoma (Paediatrics) 463
67. Ewing Sarcoma 475
68. Ewing Sarcoma (Paediatrics) 481


## Other Malignancies


69. Oncologic Emergencies 487
70. Paediatric Germ Cell Tumour 507

## Other Topics in Oncology


71. Tumour Lysis Syndrome 526

72. Cardiotoxicity of Chemotherapy Agents 535

73. Chemotherapy Induced Nausea and Vomiting 542

74. Immunotherapy : I 549

75. Immunotherapy : II 555


→ update :-
- Cancer Cachexia
- Sexual Dysfunction in Oncology
- Prescribing Nutrition
- Fatigue in Cancer Patients
- Genital dysfunction in Cancer Patients
- Newer developments in medical oncology
- Smoking Cessation.

## Pharmacology


76. Pharmacology 562

77. Alkylating Agents 568

78. Taxanes 571

79. Platinum Analogues 577

80. Miscellaneous 583

81. Topoisomerase 1 Inhibitors and Vinca Alkaloids 587


update :- Opioids in Cancer Pain management

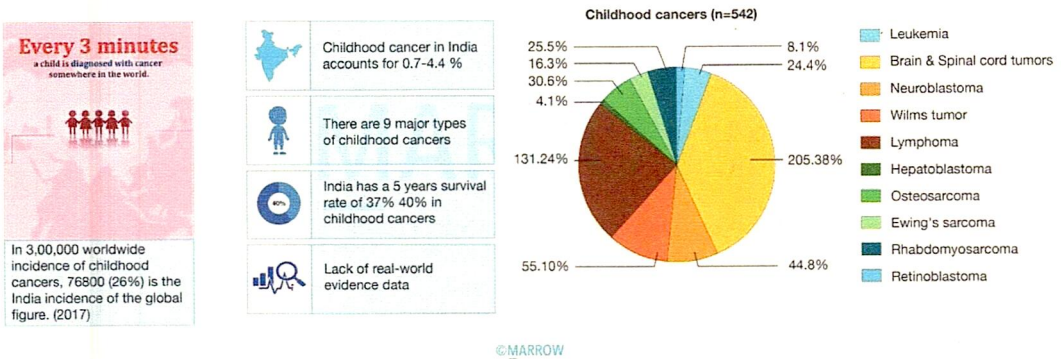
# BASICS OF PAEDIATRIC ONCOLOGY

----- Active space -----

## Introduction

00:00:23

### Statistics :




80% of children with cancer will survive in high-income countries.
Only about 20% of children with cancer will survive in some low and middle income countries.

### Roadblocks to improved cancer survival :

- Delayed diagnosis/misdiagnosis/no diagnosis.
- Lack of awareness.
- Overlap of signs and symptoms of cancer with other infectious diseases.
- Lack of diagnostic facilities.
- Symptoms of leukemia/lymphoma are often mistaken for more common nutritional deficiency/tuberculosis.
- Many patients are empirically started on ATT.
- Steroids are often used in peripheral centres without a diagnosis.

Retinoblastoma :
Early diagnosis : 100% survival.
Late diagnosis (Extraocular retinoblastoma) : 20-30% survival.



Loss of red reflex : Early retinoblastoma.



Extraocular retinoblastoma (Late).

----- Active space -----

Cost of late diagnosis :

- Poor survival rates.
- High treatment cost.

### Factors related to late diagnosis :

Patient related factors :

- Infants : Dependent on caregivers for a diagnosis.
- Adolescents : Ignoring the symptoms.

Health related factors :

- Lack of diagnosis.
- Lack of availability of cancer centres within reach.

### Children at risk :

1. Infections :
    - EBV infection : Hodgkin Lymphoma, Burkitt lymphoma, Post transplant lymphoproliferative disorder (PTLD), nasopharyngeal cancer.
    - HIV : Kaposi sarcoma, B cell lymphoma.
    - Hep B and C : Hepatocellular carcinoma.
    - HPV : HPV associated cancer.
2. Immunodeficiency syndromes.
3. Patients receiving immunosuppressive therapy : Higher risk of malignancy (PTLD and lymphomas).
4. Pediatric solid organ transplant recipients who are on prolonged thiopurine therapy : PTLD.
5. Childhood cancer survivors.
6. Exposure to alkylating agent, anthracycline, topoisomerase inhibitors.
7. Exposure to radiation.

## Signs and symptoms

00:10:31

### Fever :

- Non specific symptom.
- One of the causes of prolonged fever of unknown origin (FUO) : Occult malignancy.
- 10% or less of patients with FUO as the only symptom are later diagnosed with a malignancy.

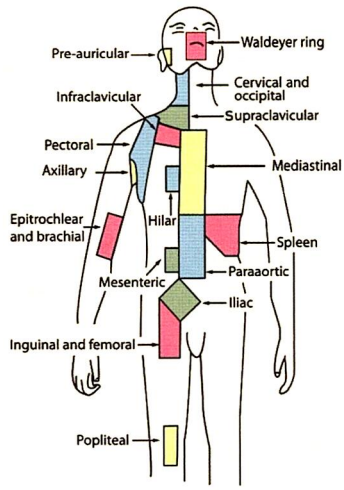
----- Active space -----

## Lymphadenopathy :

M/C cause : Reactive hyperplasia (Benign).

Enlarged lymph node could be due to :

- Intrinsic cellular components.
- Extrinsic cellular infiltration.




Lymphadenopathy.

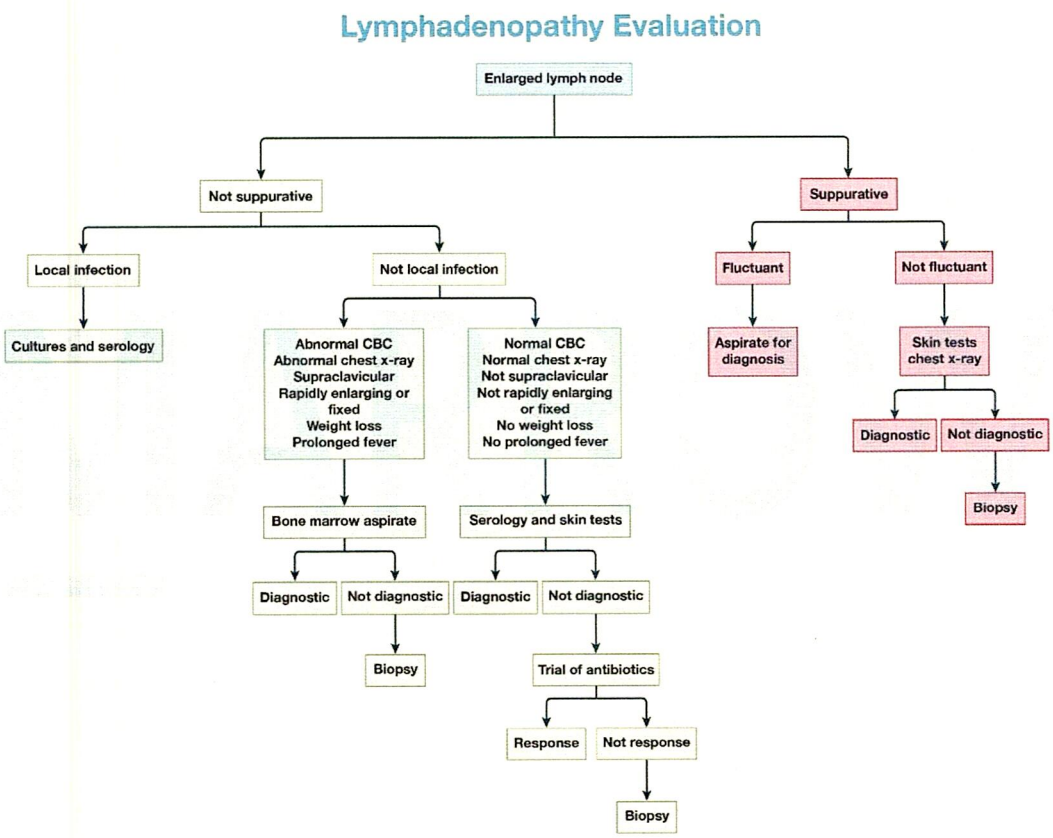
Significant lymphadenopathy :

- Cervical >1 cm.
- Axillary >1 cm.
- Epitrochlear >0.5 cm.
- Inguinal >1.5 cm.

Generalized lymphadenopathy : Significant lymphadenopathy of 2 or more noncontiguous lymph nodes.

Note :

- Palpable supraclavicular nodes should always be considered abnormal.
- Left-sided (Virchow) nodes suggest metastases from an intra-abdominal malignancy (Neuroblastoma).
- Right-sided nodes suggest intrathoracic disease.



----- Active space -----

Indications of lymph node biopsy :

- Chronic, persistent, progressive adenopathy in the absence of any infectious etiology.
- Any nodes >2.5 cm in diameter in the absence of signs of infection.
- Supraclavicular adenopathy.
- Systemic symptoms.

Cautions for lymph node biopsy :

- Avoid upper cervical and inguinal areas : Commonly d/t infections.
- Lower cervical and axillary nodes are more reliable.
- Largest node should be biopsied.
- Node should be removed intact with the capsule.
- Lymph node should be immediately submitted to the pathologist fresh or in sufficient tissue culture to prevent the tissue from drying out.
- The node must not be left in strong light (Subject to heat) and should not be wrapped in dry gauze (Drying) : may produce a drying artefact.
- Fresh and frozen samples should be set aside for additional studies, as noted later.

**Intracranial mass :**

Red flag signs of headache :

- Recurrent early morning vomiting.
- Headache that awakens the child from sleep.
- Incapacitating headache.
- Enlargement of head size (In infants).
- C/F associated with raised ICT (Intracranial tension).

| Risk group | Clinical definition | Probability of brain tumor % | Diagnostic strategy |
|---|---|---|---|
| Low | Headache >6 months and no neurologic symptoms. | 0.01 | No imaging. Clinical follow-up and medical treatment. |
| Intermediate | Migrane HA and no neurologic symptoms. | 0.4 | CT, MRI followed by biopsy or surgery. |
| High | Headache <6 months and one clinical predictor of space occupying lesion. | 4 | MRI followed by biopsy or surgery. |

## Abdominal masses :

----- Active space -----

Palpable abdominal mass : M/C presenting feature.

Age of patient :

- Neonatal period : Congenital malformation of GI and GU system.
- Childhood : Malignant.

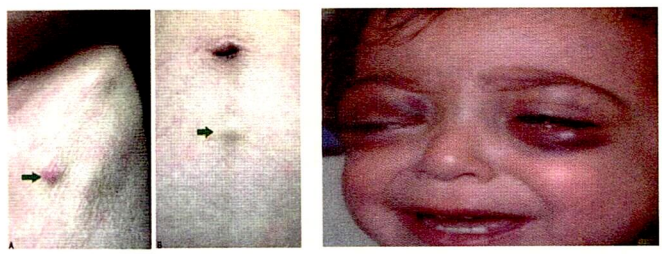
Site :

| Upper abdomen | Mid abdomen | Lower abdomen |
|---|---|---|
| Neuroblastoma.<br>Wilms tumor.<br>Hepatoblastoma.<br>Lymphoma. | Lymphoma.<br>Sarcoma.<br>Germ cell tumor. | Germ cell tumor.<br>Sarcoma.<br>Lymphoma. |

History and physical examination :

Systemic symptoms :

- Periorbital ecchymosis (Racoon eyes).
- Subcutaneous nodules.
- Bone pains.



Subcutaneous nodules, periorbital ecchymosis.

Investigations :

- Ultrasound abdomen.
- Mass arising from liver : Serum alpha fetoprotein (AFP).
- Tumour markers : β-HCG.

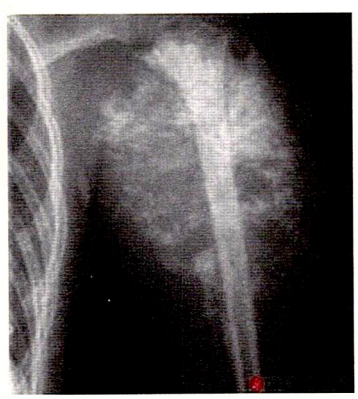
## Bone pain :

Localized bone pain with limping :

- Osteosarcoma.
- Ewing sarcoma.

Features of malignant bone tumor :

- Cortical erosion.
- Irregular mass.
- Periosteal reaction.
- White zone of transition.



Malignant bone tumor.

Diffuse bone pain is a cardinal feature of acute leukemia.

Differential diagnosis : Juvenile rheumatoid arthritis.

----- Active space -----

| | Acute leukemia | JRA |
|---|---|---|
| Symptom manifestation | Worse at night. | Morning stiffness. |
| Involvement | Bones and joints. | Joints. |
| Constitutional symptoms | Present. | Present/absent. |

Acute leukemia vs juvenile rheumatoid arthritis (JRA).

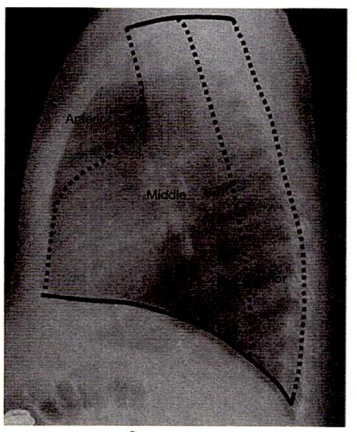
## Mediastinal tumors

00:23:11

### Parts of mediastinum :

Anterior mediastinum : Anteriorly by the sternum and posteriorly by pericardium.

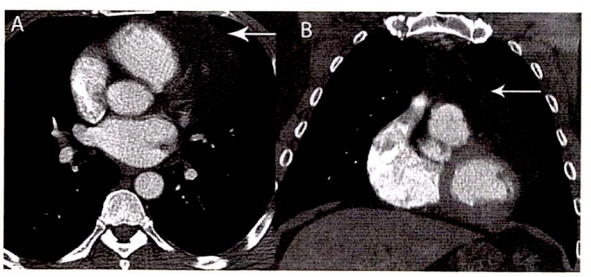
Middle mediastinum : Between the anterior border of pericardium and an imaginary line drawn 1 cm posterior to the anterior border of the vertebral bodies.




Parts of mediastinum.

Posterior mediastinum : Anteriorly by an imaginary line drawn 1 cm posterior to the anterior border of the vertebral bodies and posteriorly by the posterior paravertebral gutters.

Anterior mediastinal mass :



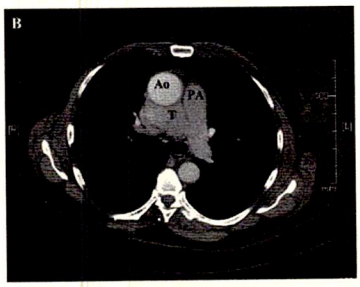

Anterior mediastinal mass.

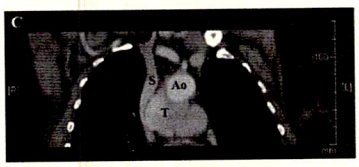
| Benign | Malignant |
|---|---|
| Teratoma | Non-Hodgkin's lymphoma |
| Cystic hygroma | Hodgkin's disease |
| Haemangioma | Teratoma with yolk sac tumour |
| Thymic cyst | Seminoma |
| | Desmoid |
| | Sarcoma |
| | Thymoma |

Causes of anterior mediastinal mass.

Middle mediastinal mass :

----- Active space -----



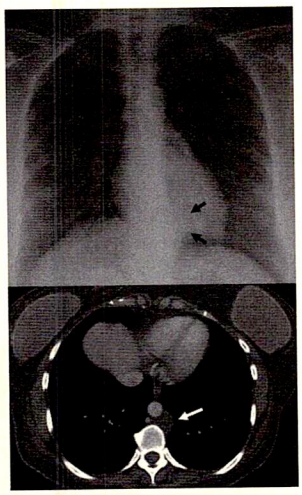




Middle mediastinal mass.

| Benign | Malignant |
|---|---|
| Bronchogenic cyst<br>(Tracheal duplication cyst)<br>Teratoma<br>Plasma cell granuloma<br>Cardiac rhabdomyoma | Hodgkin's disease<br>Non-Hodgkin's lymphoma<br>Teratoma<br>Rhabdomyosarcoma<br>Other sarcomas |

Causes of middle mediastinal mass.

Posterior mediastinal mass :



Posterior mediatinal mass.

| Benign | Malignant |
|---|---|
| Ganglioneuroma<br>Neurofibroma<br>Enterogenous cyst<br>Teratoma (Rare)<br>Lipoma<br>Leiomyoma | Neuroblastoma,<br>Ganglioneuroblastoma<br>Neurofibrosarcoma<br>Sarcoma<br>Liposarcoma<br>Leiomyosarcoma<br>Sarcoma |

Causes of posterior mediastinal mass.

## Lung tumors

00:26:03

- Primary malignancies of the lung and tracheobronchial tree : Rare.
- Inflammatory myofibroblastic tumor : m/c lung tumor in pediatrics.
- Bronchial carinoid : Intense contrast enhancement related to their fibrovascular stromal component.
- Mucoepidermoid carcinoma.
- Bronchogenic carcinoma.

### Pleuropulmonary blastomas (PPB) :

Type I :

- Purely cystic tumors occurring <2 years of age.
- Median age of 10 months, 5-year DFS : 90%.

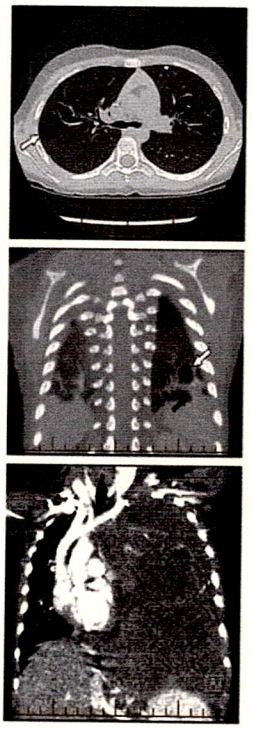
----- Active space -----

Type II :

- Cystic and solid tumors.
- Median age of 35 months.

Type III :

- Solid tumors, median age of 41 months.
- Surgical resection is recommended if feasible, followed by chemotherapy and/or radiation therapy, intracavitary chemotherapy.
- 5-year DFS : 50-60%.
- Associated with germline pathogenic DICER1 variants.
- Susceptible to other tumors :
  - Cystic nephromas.
  - Ovarian stromal sex cord tumors.
  - Thyroid and other endocrine tumors.
  - Embryonal rhabdomyosarcoma.
  - Brain tumors.

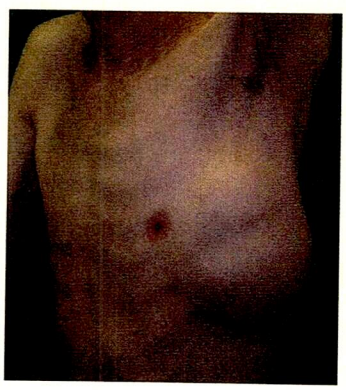


Pleuropulmonary blastomas.

## Chest wall tumors

00:27:22

May arise from bone or soft tissues.
m/c : metastatic rib lesions (Neuroblastoma, Langerhans cell histiocytosis, lymphoma, leukemia).



Chest wall tumor.

m/c paediatric chest wall primary malignancies :

- Rhabdomyosarcoma.
- Extraosseous Ewing sarcoma.
- PNET of the chest (Askin tumor).

Primary bone malignancies :

- Ewing sarcoma.
- Osteosarcoma.

May arise from the ribs, thoracic vertebrae, or scapulae and manifest as chest wall masses.

Non malignant chest wall masses :

- Neurofibromas.
- Hemangiomas, vascular malformations.

----- Active space -----

- Aneurysmal bone cysts.
- Osteochondromas.
- Healing rib fractures.
- Osteomyelitis.
- Developmental variations of the thoracic cage.

### Indications of immediate evaluation of back pain :

- Bowel/bladder dysfunction.
- Paresis.
- Gait abnormalities.
- Paraesthesia.

Risk of spinal cord compression : Emergency.

Immediate MRI scanning.

Start dexamethasone.

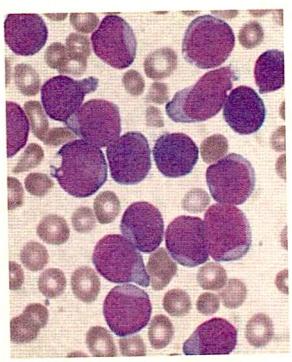
## Peripheral blood abnormalities

00:29:33

### Investigations :

1. Complete blood counts :
   - Pancytopenia/bicytopenia.
   - Leukocytosis.

2. Peripheral smear (PS) : Presence of blasts.



Blast cells on PS.

3. Bone marrow studies :

Indications for bone marrow studies :

- Patients with pancytopenia/more than one depressed cell line.
- Presence of blasts on peripheral smear.
- Presence of leucoerythroblastic changes on PS.
- Association with unexplained lymphadenopathy, bone pain, or hepatosplenomegaly.
- Association with an anterior mediastinal mass.

Diagnosis of leukemia :

- ≥20% bone marrow lymphoblasts in bone marrow study.
- Peripheral blood sample may be substituted if a sufficient level of circulating lymphoblasts is present.

----- Active space -----

Stains to distinguish lymphoblasts from myeloblasts :

- Wright-Giemsa-stained bone marrow aspirates.
- Hematoxylin and eosin (H&E) stained biopsies.

Features of lymphoblast :

- High nucleus-to-cytoplasm ratio.
- Absence of nucleoli.
- Smaller size.

4. Flow cytometry.

5. Immunophenotyping :

B cells : CD10, CD19, CD20, CD45, Kappa, lambda.

T cells : CD2, CD3, CD4, CD5, CD7, CD8, CD45.

Myelomonocytic cells : CD11b, CD13, CD14, CD15, CD16, CD33, CD34, CD45, CD117, HLA-DR.

6. Chromosomal analysis and banding :

Essential for the identification of aneuploidy, microscopic chromosomal anomalies, and some translocations.

Common translocation in ALL :

- t(12 ; 21) : m/c translocation in childhood ALL, favorable prognosis.
- t(1 ; 19) : Bad prognosis.
- t(9;22) : Very poor outcome.
- 11q23 rearrangements : Poor outcome.
- t(5;14).

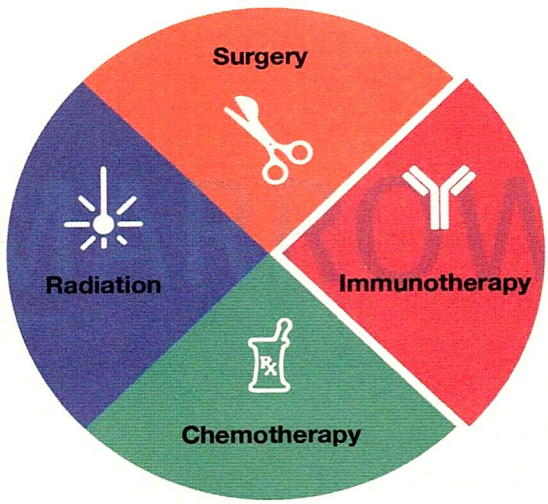
Used for risk stratification.

Note :

In case of suspicion of leukemia, do not give steroids during a blood transfusion or in case of transfusion reaction as it can delay the diagnosis.

Modalities of treatment :

----- Active space -----




THE GOAL OF THE GLOBAL INITIATIVE IS TO ACHIEVE AT LEAST A

60% SURVIVAL

AND TO REDUCE SUFFERING FOR ALL CHILDREN WITH CANCER BY 2030.

**1 MILLION**

CHILDREN WITH CANCER CAN BE SAVED IN THE NEXT DECADE.

Key home message :

- Childhood cancer is a highly curable disease.
- Increase awareness about symptoms and signs of childhood cancer.
- Early diagnosis.
- Early referral to the pediatric oncology unit.

----- Active space -----

# EPIDEMIOLOGY AND MOLECULAR BIOLOGY OF PAEDIATRIC CANCER

## Introduction

00:00:17

Tissue homeostasis depends on the regulated cell division and self-elimination (Programmed cell death) of each of its constituent members except its stem cells.

A tumor arises as a result of :

- Uncontrolled cell division.
- Failure for self-elimination.

Alterations in genes responsible for the deregulated control mechanisms that are the hallmarks of cancer cells :

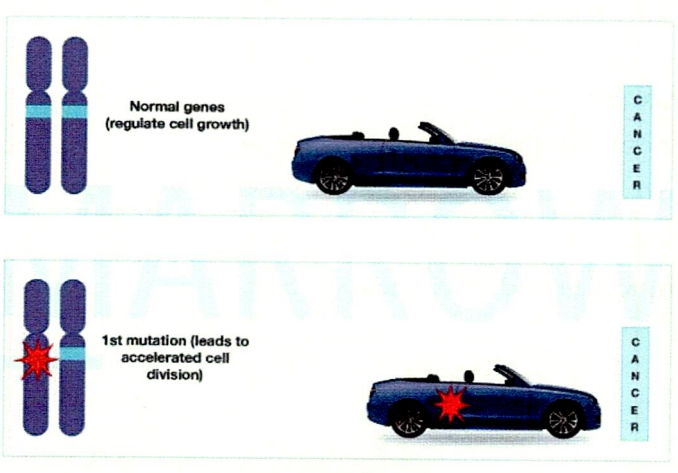
- Proto-oncogenes.
- Tumor supressor genes.
- DNA stability genes/DNA repair genes.

## Genes involved

00:01:18

### Oncogenes :

It is a proto-oncogene → Mutated → Leads to signals that cause uncontrolled growth i.e., cancer.




Mechanism of oncogenes

----- Active space -----

HER-2/neu :

- Encodes for a cell surface receptor that can stimulate cell division.
- Amplified in up to 30% of human breast cancers.

RAS :

- Involved in Kinase signaling pathways → Controls transcription of genes, regulating cell growth and differentiation.

MYC :

- Encodes transcription factor and controls expression of several genes.

SRC :

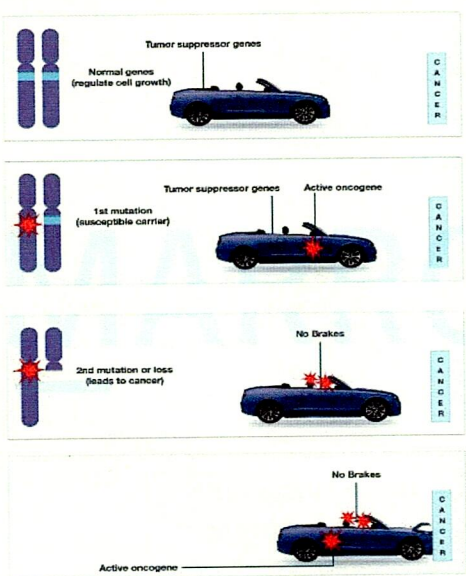
- First oncogene ever discovered.
- Is a tyrosine kinase → Regulates cell activity.

hTERT :

- Codes for telomerase → maintains chromosome ends.

**Tumor suppressor gene :**

- Segments of DNA that code for negative regulator proteins which keep the cell from undergoing uncontrolled division.
- Braking signals during phase G1 of the cell cycle, to stop or slow the cell cycle before S phase.
- Mutations in tumor suppressor genes cause loss-of-function, resulting in uncontrolled cell growth, i.e, cancer.




mechanism of tumor suppressor gene

Tumour suprresor genes are normal genes whose absence can lead to cancer.

----- Active space -----

Examples of cancer predisposition genes and their associated syndromes :

| Tumor suppressor gene | Syndrome | Tumor |
|---|---|---|
| Rb | Retinoblastoma. | Retinoblastoma. |
| WT 1 | Familial Wilm's tumor. | Wilm's tumor. |
| NIF 1 | Neurofibromatosis type 1. | Neurofibroma, sarcoma. |
| NIF 2 | Neurofibromatosis type 2. | Schwannoma, meningioma. |
| APC | Familial adenomatosis polyposis. | Tumors of colon, stomach and intestine. |
| p53 | Li-Fraumeni syndrome. | Breast, lung, brain tumors, sarcoma. |
| VHL | Von Hippel-Lindau disease. | Tumors of kideny, adrenal. |
| E-CAD | Familial gastric cancer. | Tumor of stomach, breast. |
| PTCH | Gorlin syndrome. | Basal cell carcinoma. |
| PTEN | Cowden syndrome. | Hamartoma. |
| MEN 1 | multiple endocrine neoplasia. | Tumors of pituitary, pancreas and parathyroid. |

P53 gene :

Normal p53 :

