Clinical Practice in Pediatrics
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MASSES FROM HEAD TO TOE

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THAI POG
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CHILDREN'S ONCOLOGY GROUP

คำแนะนำ

กรณีมือถือ / แท็บเล็ต

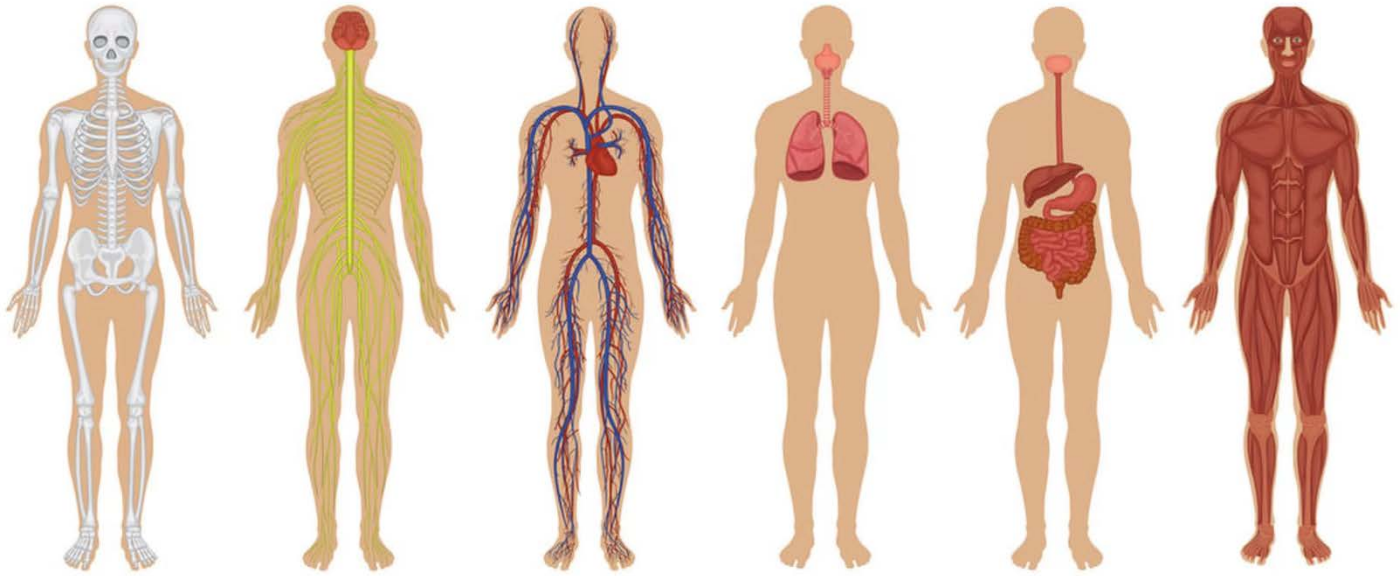
1. เปิดโปรแกรมอ่าน QR code จาก LINE หรือโปรแกรม QR code scanner (ดาวน์โหลดจาก Play store)
2. สแกน QR code จากนั้น เครื่องจะเปิดเอกสารโดยอัตโนมัติ
3. บันทึกเอกสารไว้ในเครื่อง โดยการคลิกปุ่มลูกศร ⬇

กรณี notebook / PC

1. เปิด browser เช่น Chrome, internet explorer, Firefox ฯลฯ
2. พิมพ์ URL address ในช่องด้านบนสุด แล้วกดปุ่ม ENTER จากนั้น เครื่องจะเปิดเอกสารโดยอัตโนมัติ
3. บันทึกเอกสารไว้ในเครื่อง โดยการคลิกที่ปุ่มลูกศร ⬇

MASS

Benign vs. Malignant



Benign masses

- Slow growing
- Firm or rubbery
- Painful
- Regular borders
- Solid or cystic consistency
- Mobile
- No infiltration
- No metastasis
- Capsulated

Malignant masses

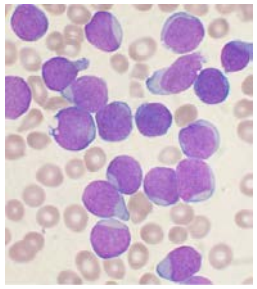
- Rapid growing
- Hard
- Painless‘
- Irregular borders
- Solid consistency
- Fixed to skin/soft tissue
- Infiltrative
- Metastasis
- Non-capsulated

Differential Diagnosis

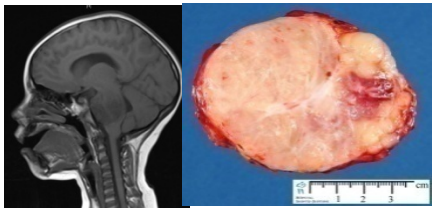
- Age
- Location
- Pattern of growth
- Constitutional symptoms
- Associated symptoms: pain, anemia etc.

Pediatric Malignancies

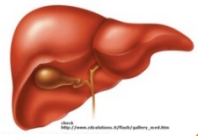
Leukemia



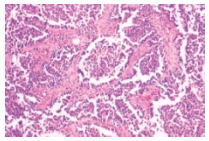
CNS tumors



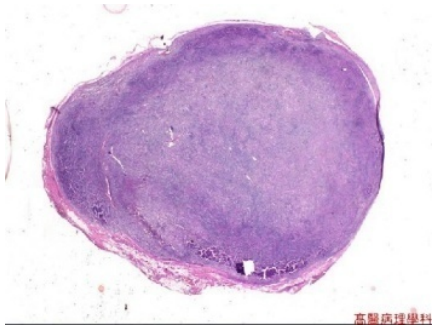
Liver tumors



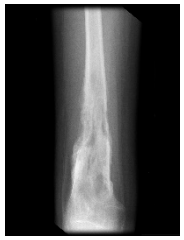
Embryonal tumors



Lymphoma

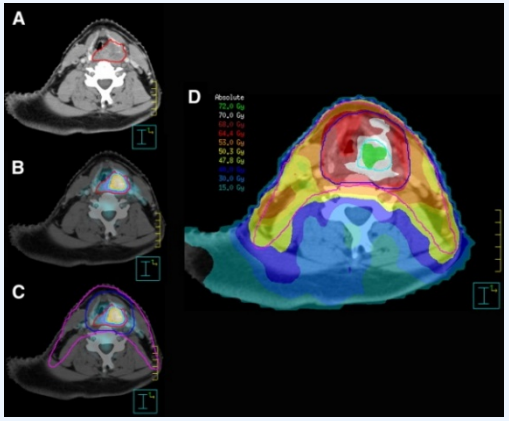


Sarcomas



Principle of Treatment in Pediatric ST

Local Control

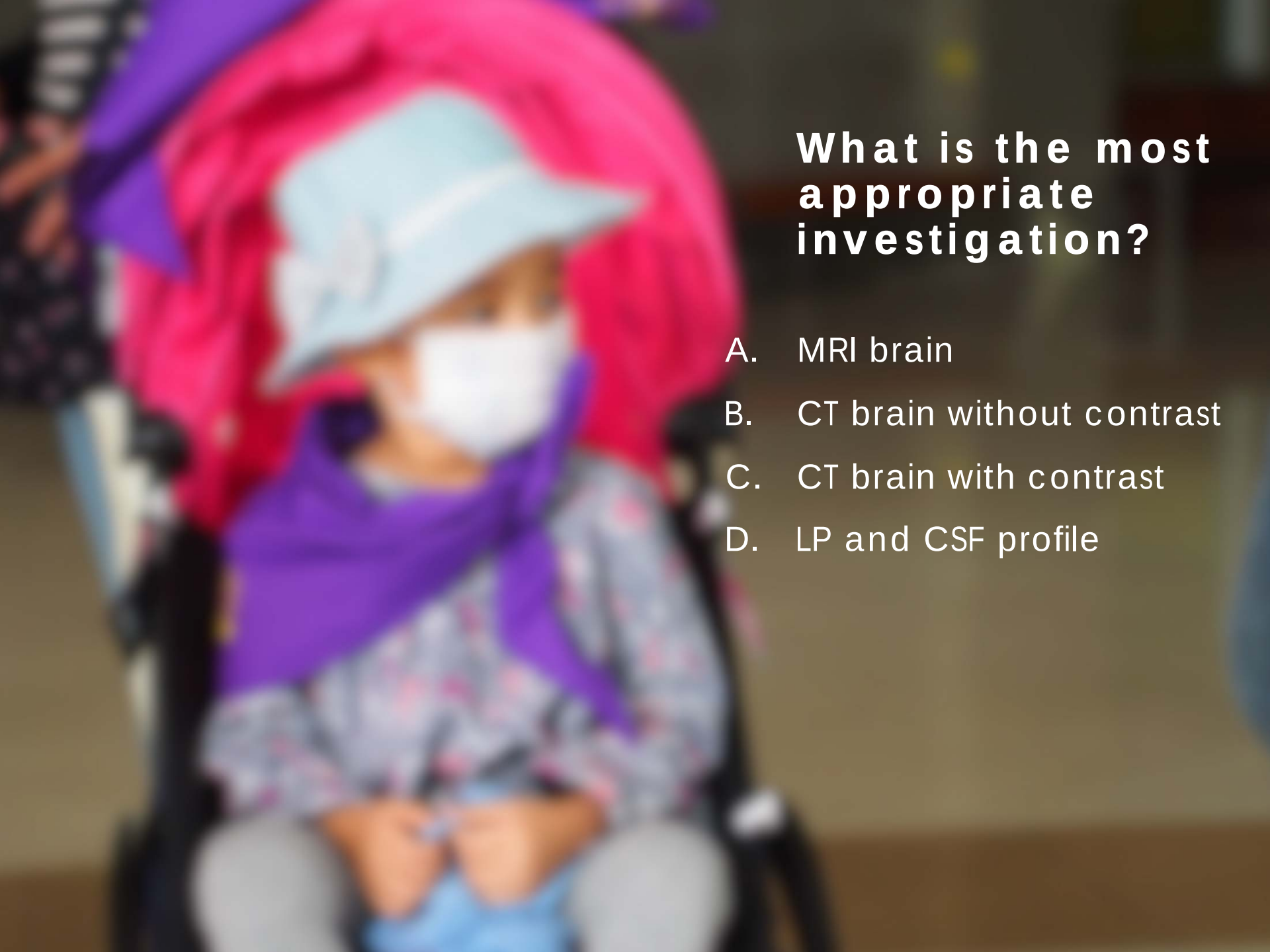


Systemic Control

2 year old girl in usual state of good health until…

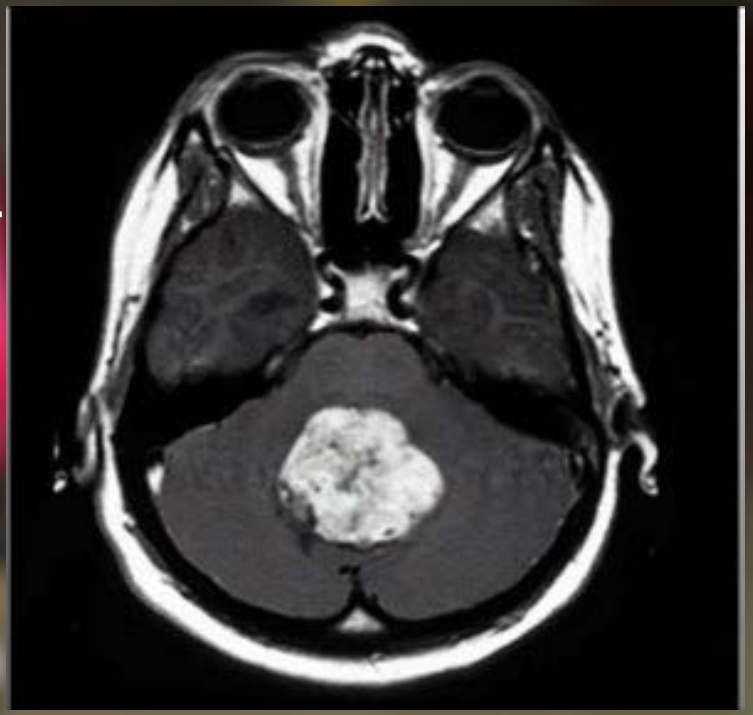
3 weeks before

- Vomiting, drowsiness
- Difficulty walking



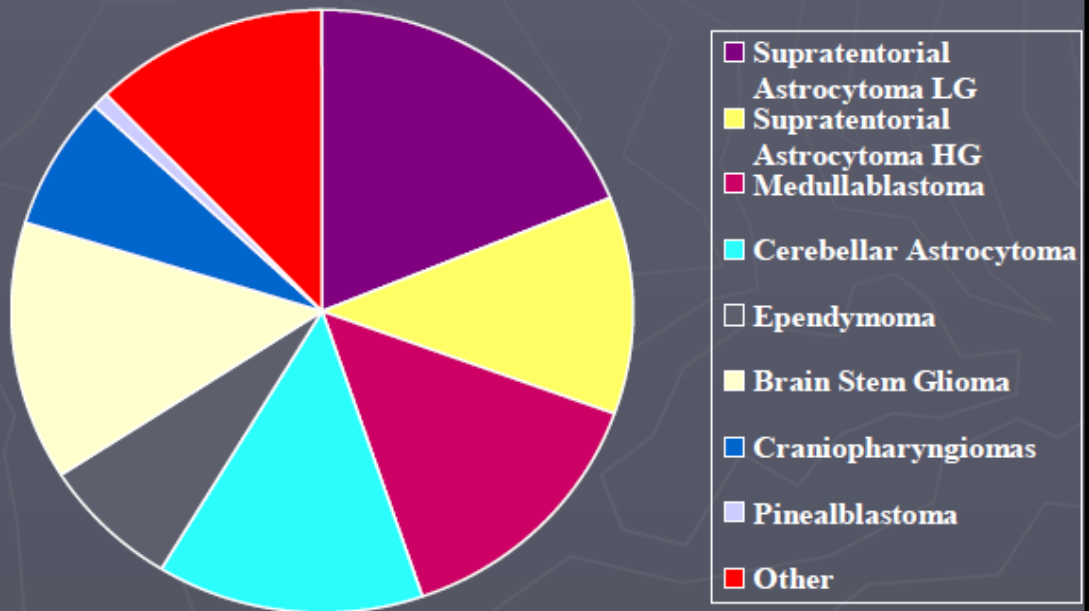
What is the most appropriate investigation?

A. MRI brain
B. CT brain without contrast
C. CT brain with contrast
D. LP and CSF profile

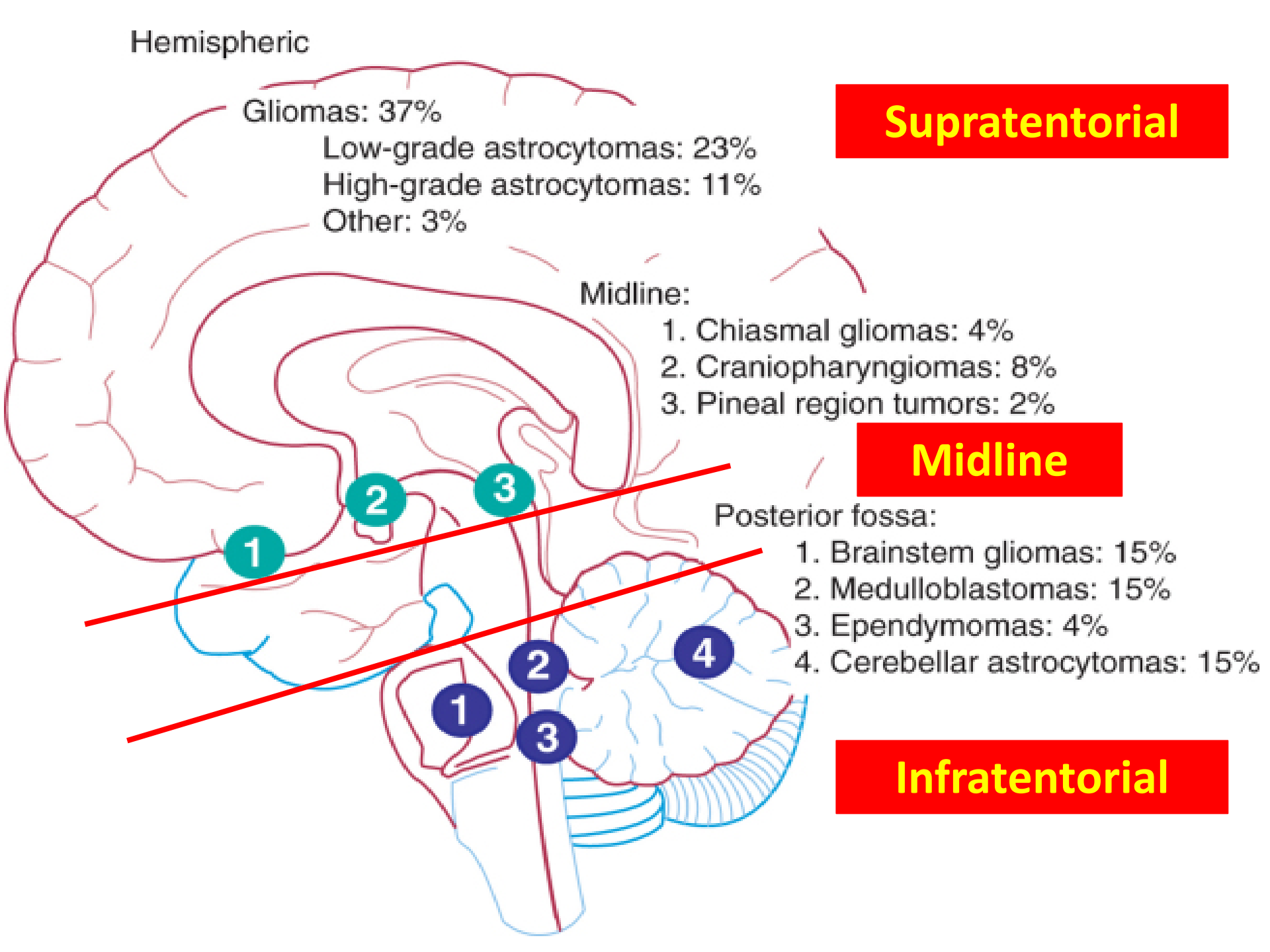


Brain Tumors

- Most common solid tumor
- Astrocytomas - most common family of brain tumors
  - Low grade astrocytomas, brainstem glioma, anaplastic astrocytoma and glioblastoma multiforme



Strother, D. R., Pollack, I. F., Fisher, P. G., Hunter, J. V., Woo, S. Y., Pomeroy, S. L, & Rorke, L. B. (2002). Tumors of the Central Nervous System. In P. A. Pizzo & D. G. Poplack (Eds.), *Principles and practice of pediatric oncology 4th Ed.* (pp. 752). Philadelphia: Lippincott Williams & Wilkins.


Hemispheric
Gliomas: 37%
Low-grade astrocytomas: 23%
High-grade astrocytomas: 11%
Other: 3%
Supratentorial
Midline:
1. Chiasmal gliomas: 4%
2. Craniopharyngiomas: 8%
3. Pineal region tumors: 2%
Midline
Posterior fossa:
1. Brainstem gliomas: 15%
2. Medulloblastomas: 15%
3. Ependymomas: 4%
4. Cerebellar astrocytomas: 15%
Infratentorial
1
2
3
1
2
3
4

Presentation

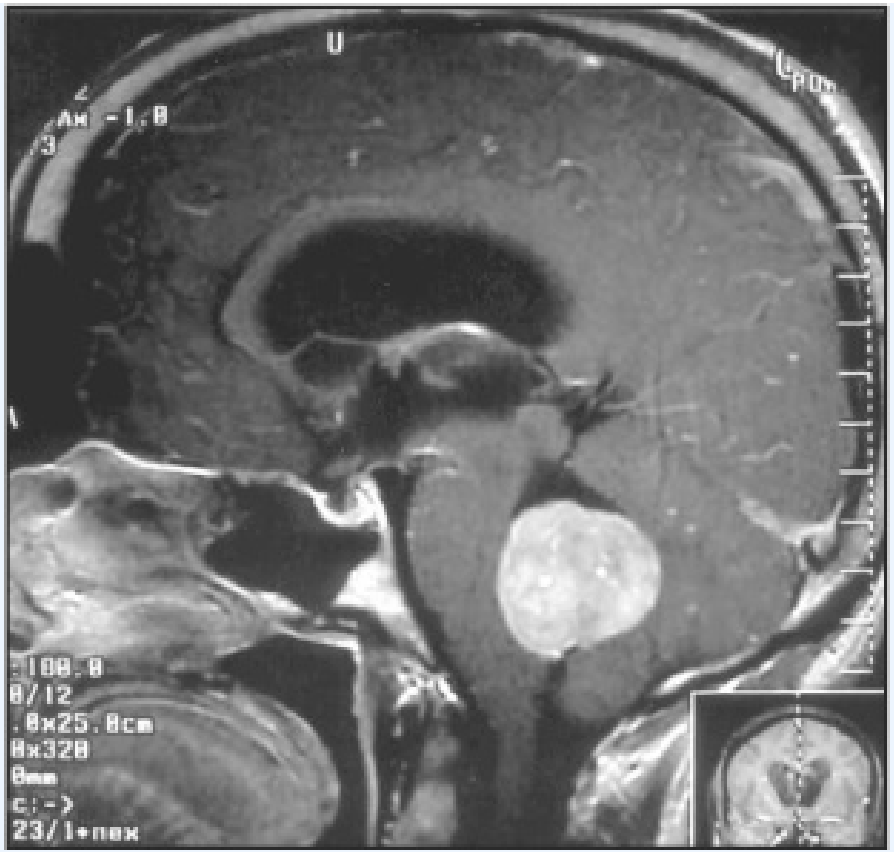
- Related to
  - Location
  - Size
  - Growth rate of tumor
- MCM is increased intra cranial pressure (47%)

Medulloblastoma

- Posterior fossa/cerebellar tumor
- Infratentorial
- Bimodal age : 3-4 yo and 6-9 yo
- 14-43% CNS seeding
- <4% distant metastasis outside CNS
- Genetic association
  - Li Fraumei syndrome (TP 53 mutation)
  - Turcot syndrome (APC mutation, 5q21-22) : associated with CA colon
  - Ataxia telangiectasia (ATM mutation)

Medulloblastoma

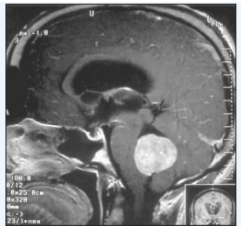
Clinical presentations



- Obstructive hydrocephalus
- Cerebellar dysfunction
- Infant :
  - Macrocephaly
  - Splitting suture
  - Buldging AF

Medulloblastoma

Treatment



- Obstructive hydrocephalus
- Cerebellar dysfunction

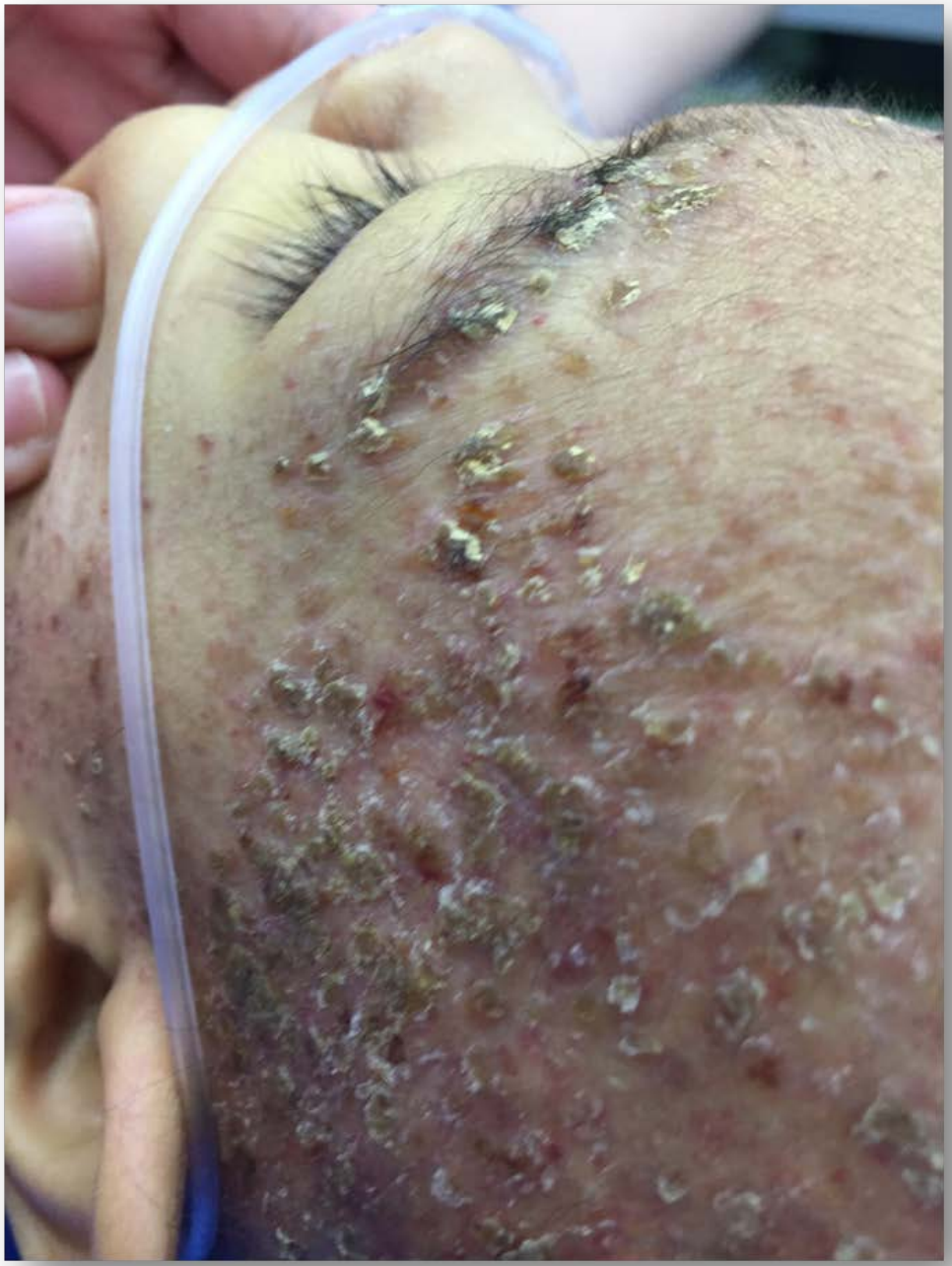
- Infant :
  - Macrocephaly
  - Splitting suture
  - Buldging AF

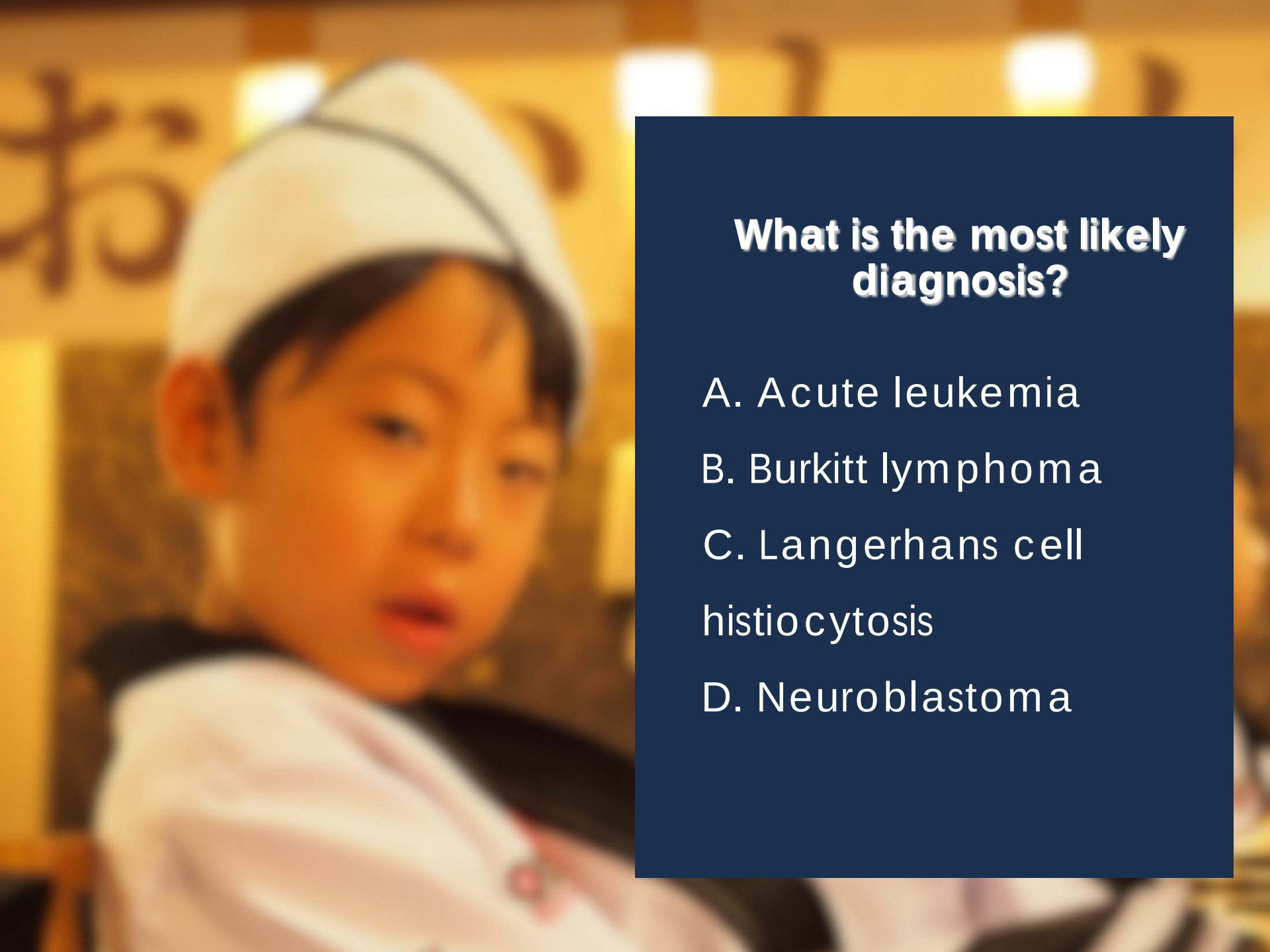
- Surgery
- RT :
  - Average risk : CSI 24 Gy
  - High risk : CSI 36 Gy

  } + whole PF boost 54-56 Gy

  - Plus concurrent VCR weekly
- Chemotherapy
  - Improved survival
  - Decreased extracranial relapse


One-year old boy with history of recurrent otitis media and polyuria.
On examination cradle cap was noticed.





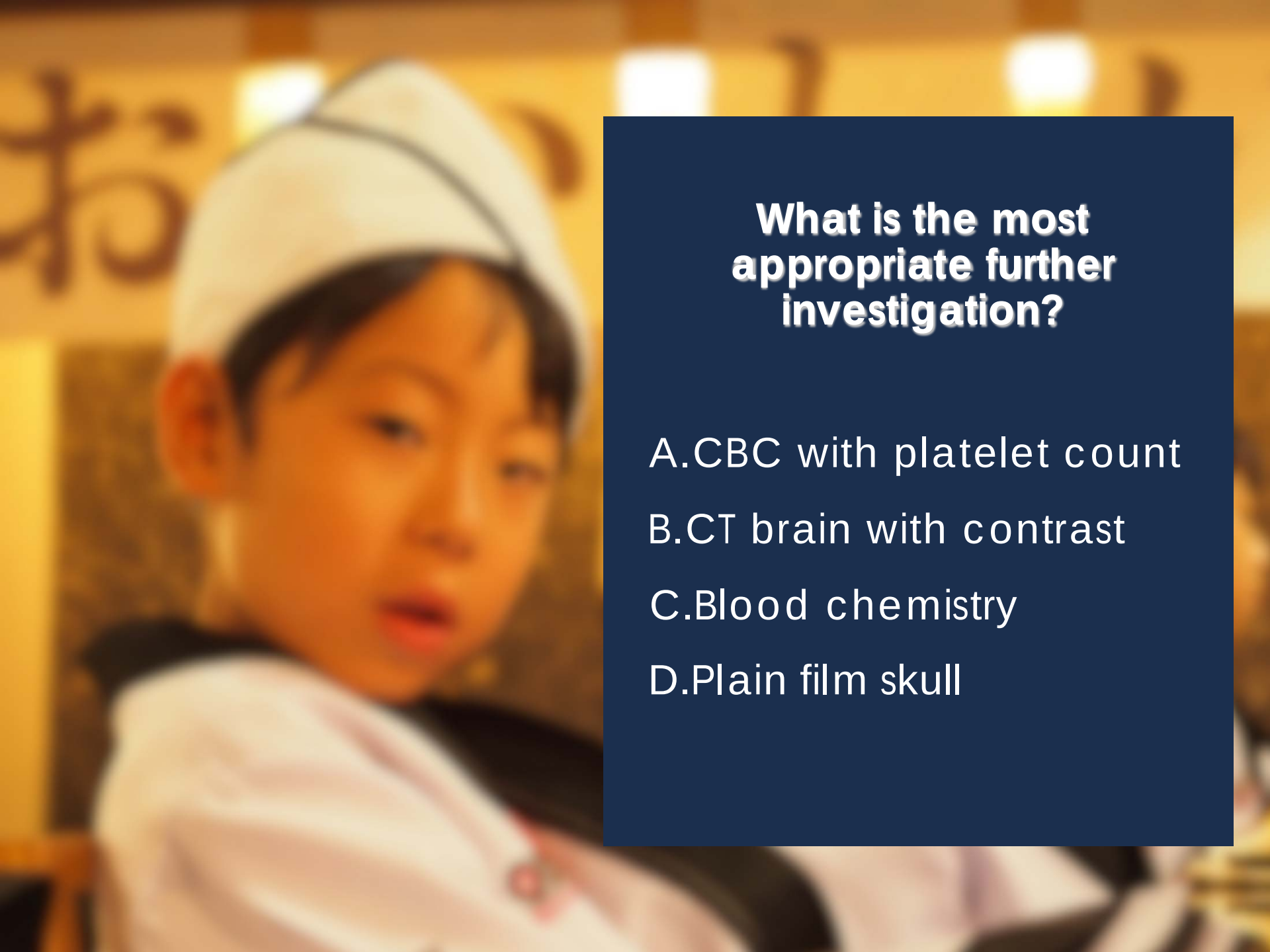
What is the most likely diagnosis?

A. Acute leukemia

B. Burkitt lymphoma

C. Langerhans cell histiocytosis

D. Neuroblastoma



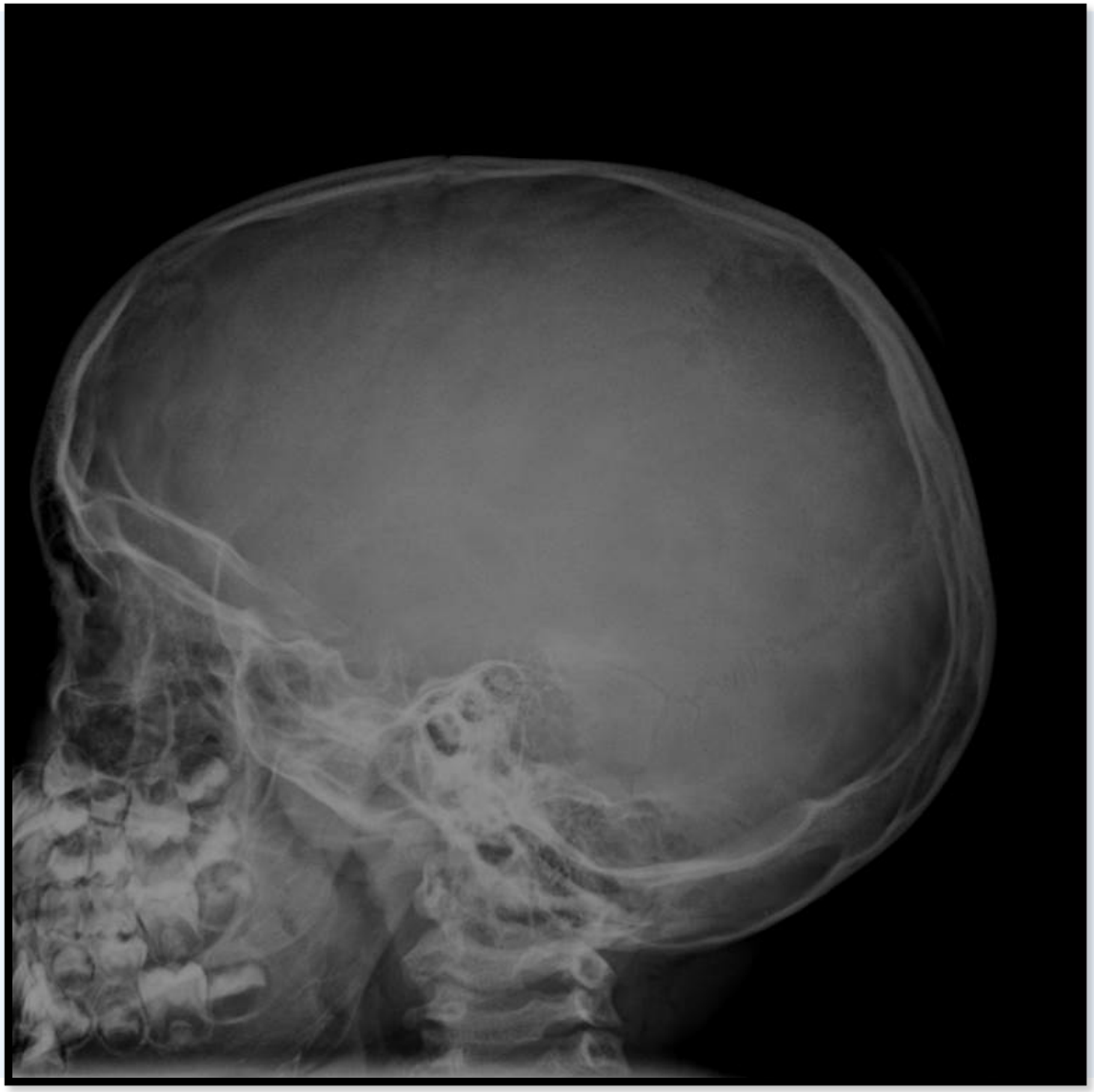
What is the most appropriate further investigation?

A. CBC with platelet count

B. CT brain with contrast

C. Blood chemistry

D. Plain film skull



Classification of histiocytosis syndrome in children

Class	Syndrome
I **Dendritic/histiocytic disorder**	• Langerhans cell histiocytosis (LCH) • Non-LCH o Erdheim-Chester Disease – primary in adult o Juvenile xanthogranuloma (JXG) – occur in children and adult
II **Macrophage/monocytoid disorder**	• Rosai-Dorfman Disease • Hemophagocytic lymphohistiocytosis (HLH) o Primary HLH – genetic disorder o Secondary HLH- infectious associated hemophagocytic syndrome (IAHS)
III **Malignant disorder**	• Malignant histiocytosis (histiocytic sarcoma) • Monocytic/myelomonocytic leukemias

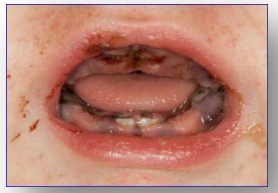
Adapted from
http://www.cancer.gov/cancertopics/pdq/treatment/lchistio/HealthProfessional

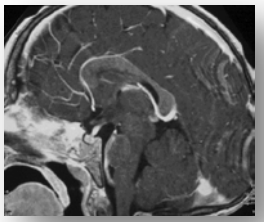
LCH

Epidemiology

- Rare
- 8-9 cases per million/year in children
  - Same in adults
- 1/10th the incidence of childhood leukemia
- Male: Female ratio is 1:1
- Median age presentation is 30 months
- Patients may present from birth to the 9th decade

LCH Organ System Involvement



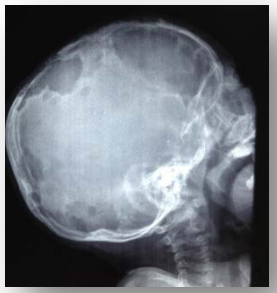


Brain
Skull and craniofacial bones

- Neuroendocrine deficits
- Neurodegeneration

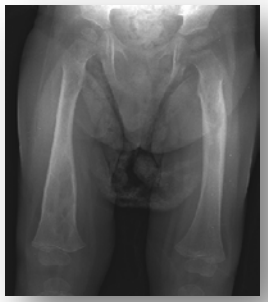
Chest

- Lung disease (infants, smokers)
- Thymus



Abdomen

- Liver
- Spleen
- GI tract



Skeleton

- Bones

Skin

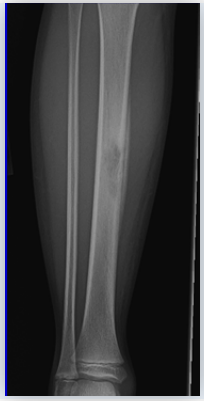
- Cradle cap, seborrhea

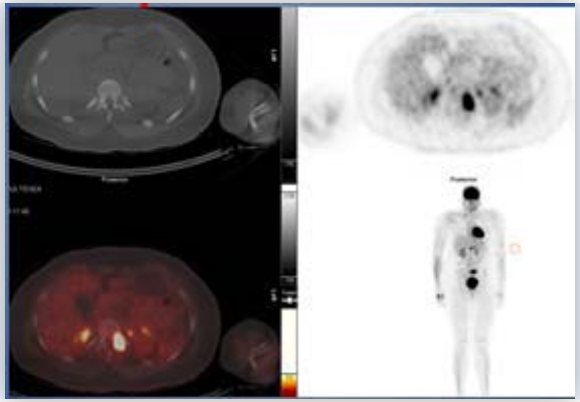
Hematopoietic system
Lymph nodes

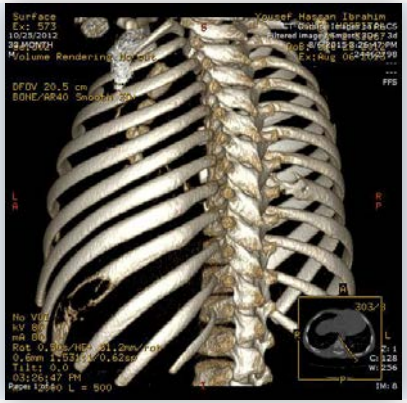
- pancytopenia, hypersplenism

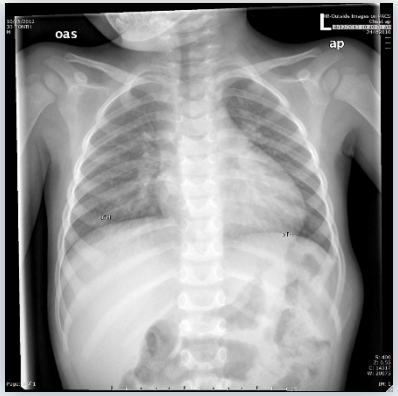
LCH Investigations

- Plain film skull
- Plain x-ray of primary lesion
- Bone survey
- CT/MRI primary lesion
- Abdominal ultrasound
- MRI pituitary
- PET scan : almost always positive in LCH
- CBC, blood chem



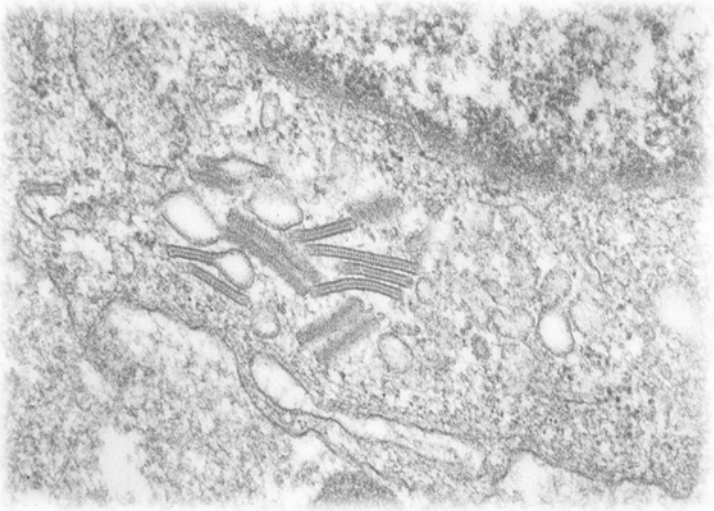


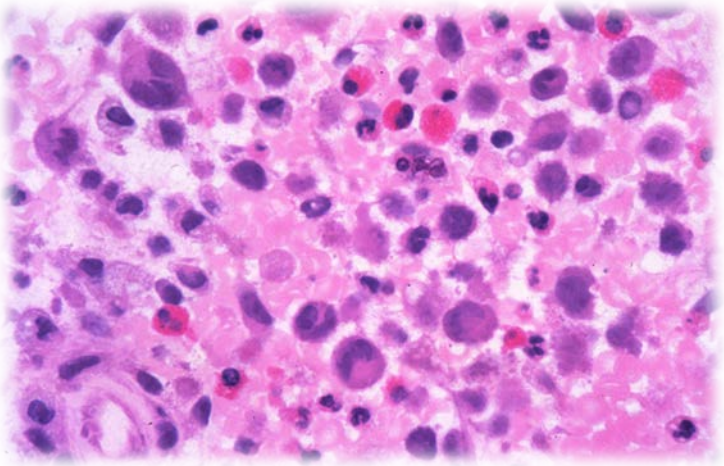




Diagnostic Histopathology

- Uniform regardless of clinical severity:
  - Diagnosis:
    - CD1a, Langerin (CD 207), S-100
    - EM: Birbeck granules



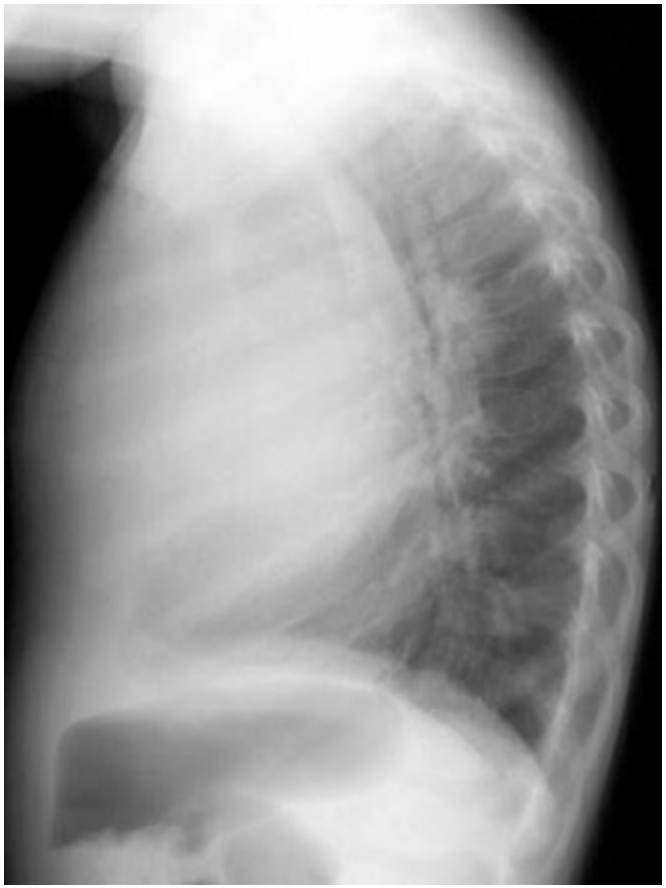


LCH Clinical Classification

- LCH-IV

Clinical Classification	Involved System	Involved Organs
Multisystem LCH (MS-LCH) (Group 1)	≥ 2	RO+/- (e.g. hemato, liver, and/or spleen)
Single System LCH (SS-LCH) (Group 2)	1 (UF/MF)	• Bone UF (single bone) or MF (>1 bone) • Skin • LN (excluding draining LN of another LCH lesion) • Lungs • Special site (eg. Vertebrae, spine) • "CNS-risk" • Central nervous system (CNS) • Other (e.g. thyroid, thymus)

10 year-old boy with 1 week history of cough and fatigue



What is the most likely diagnosis?

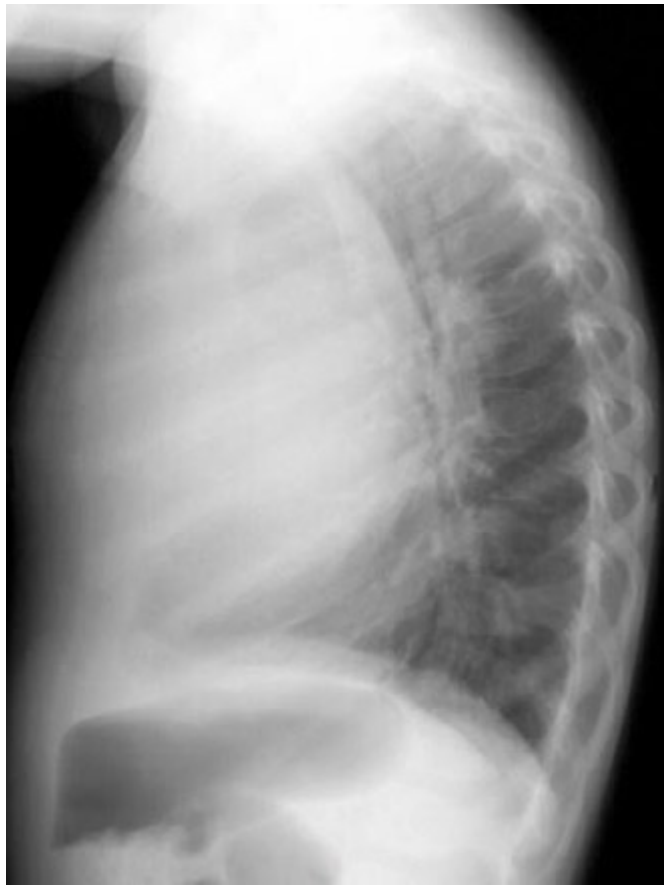
A. Askin's tumor

B. Rhabdomyosarcoma

C. Ganglioneuroma

D. Germ cell tumor

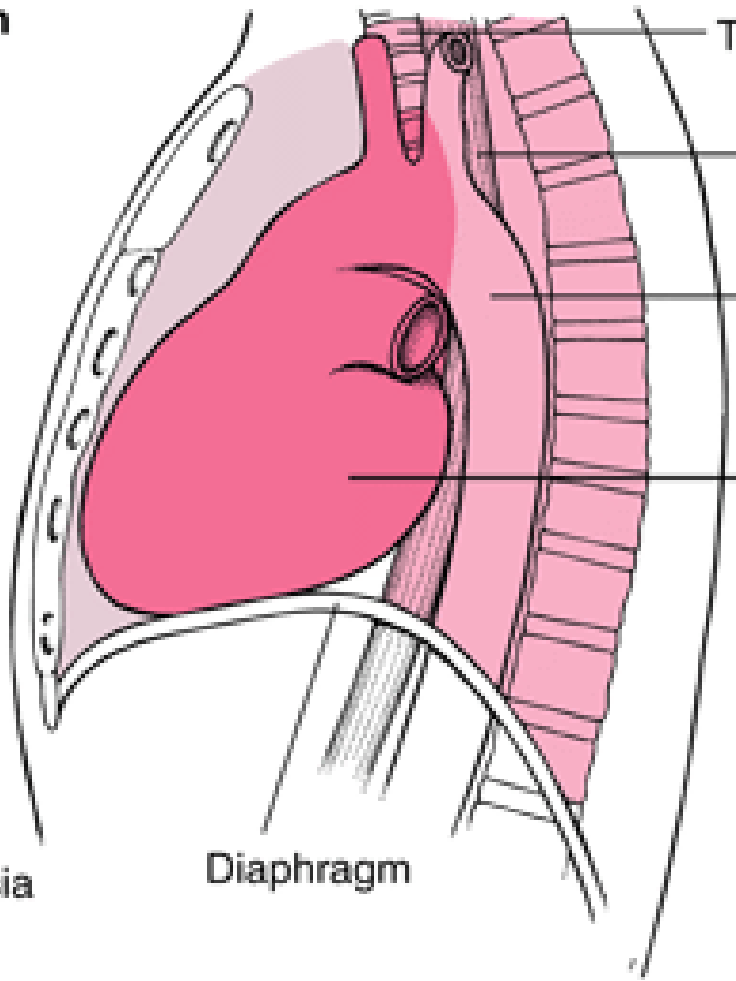
E. Hodgkin's lymphoma



Mediastinal mass

Anterior mediastinum
- Aneurysm
- Angiomatous tumor
- Goiter
- Lipoma
- Lymphoma
- Morgagni hernia
- Parathyroid tumor
- Pericardial cyst
- Teratoma
- Thymoma
- Thyroid tumor

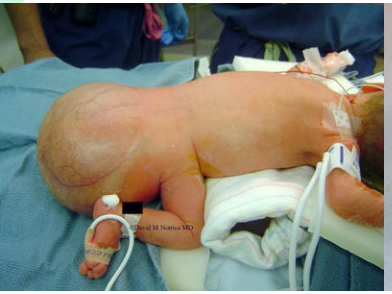
Middle mediastinum
- Bronchogenic cyst
- Bronchogenic tumor
- Lymph node hyperplasia
- Lymphoma
- Pleuropericardial cyst
- Vascular masses

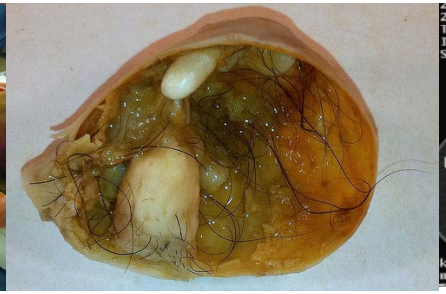


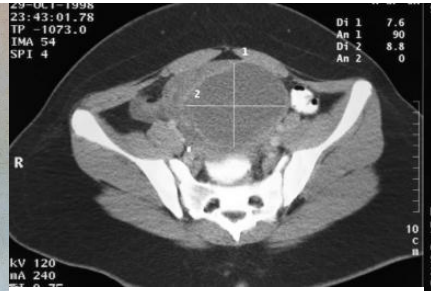
Posterior mediastinum
- Aneurysm
- Bronchogenic tumor
- Enteric cyst
- Esophageal diverticula
- Esophageal tumor
- Neurogenic tumor

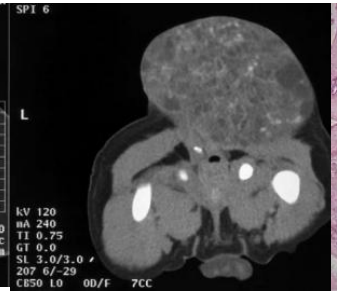
Mediastinal mass	DDx
Anterior mediastinal mass	"5T" T cell lymphoma T cell acute lymphoblastic leukemia (T cell ALL) Teratoma/Germ cell tumor Thymoma Thyroid gland
Middle mediastinal mass	Hodgkin's lymphoma Bronchogenic cyst
Posterior mediastinal mass	"Neural crest cell tumors" Neuroblastoma Ganglioneuroma Ganglioneuroblastoma Neurofibroma

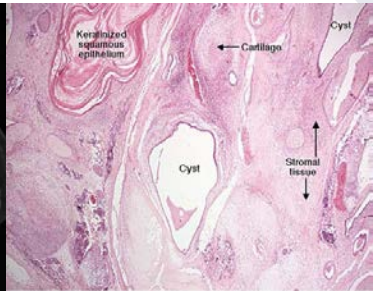
GERM CELL TUMORS





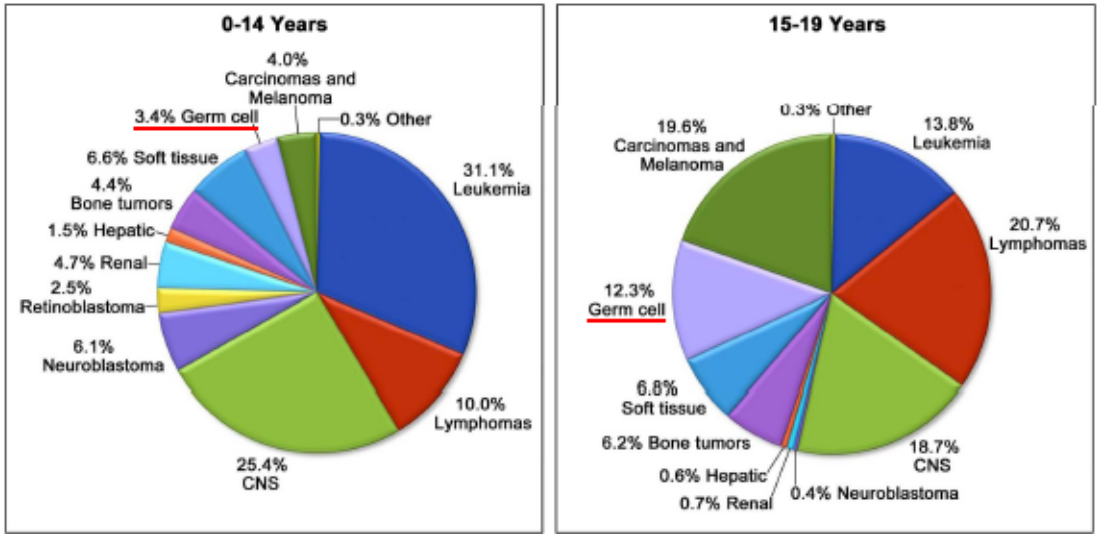


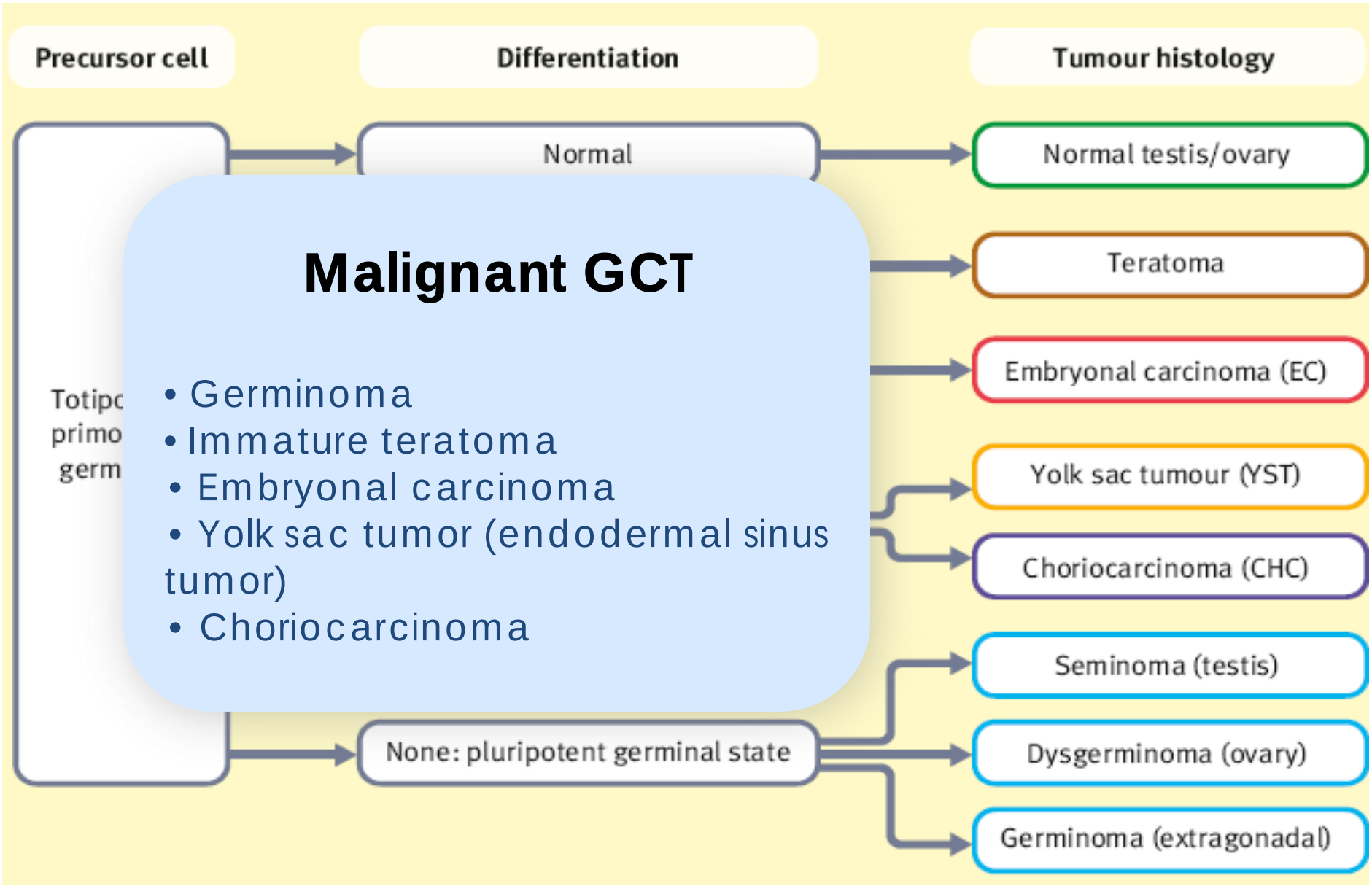




Pediatric Germ Cell Tumors

- Heterogeneous in presentation, pathology, prognosis
  - Different biologic behavior by age, site of presentation





Murray & Nicholson, Paediatrics and Child Health, 2010

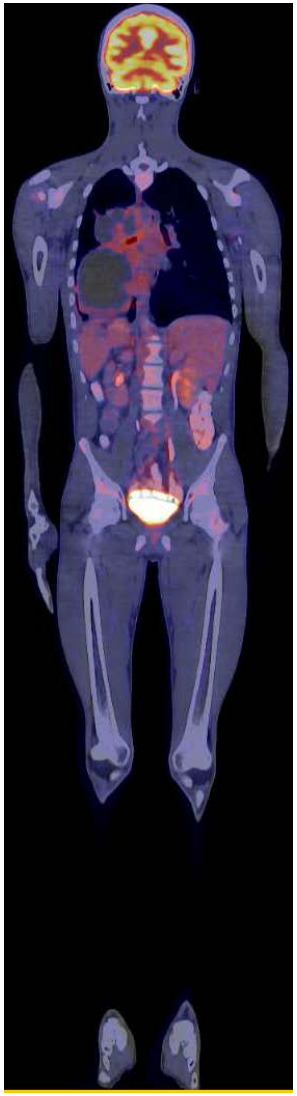
Germ Cell Tumors

Epidemiology and Sites

- 2-3 % of childhood malignancies
- 2.4 cases per million children
- Bimodal age distribution

Gonadal	Extragonadal
Ovarian	Medistinum
Testis	Sacrococcygeal
	Retroperitoneum

Metastasis

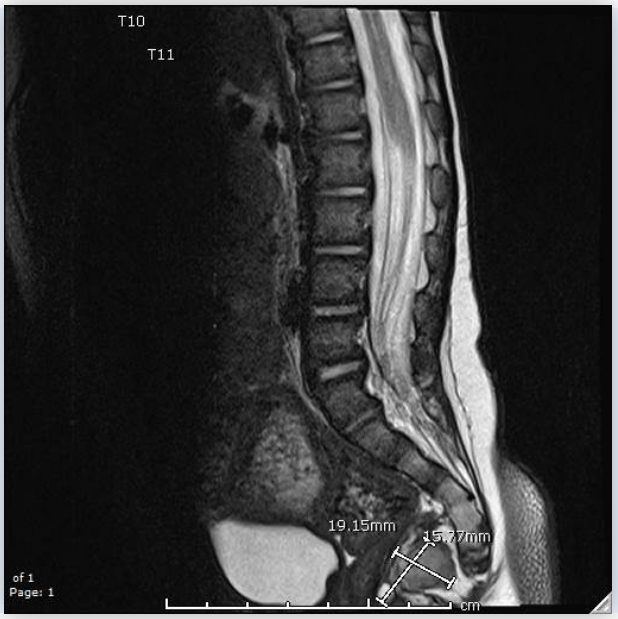


- Lungs
- Liver
- LN
- CNS
- Bone
- BM (less commonly)

Germ Cell Tumors

Investigations

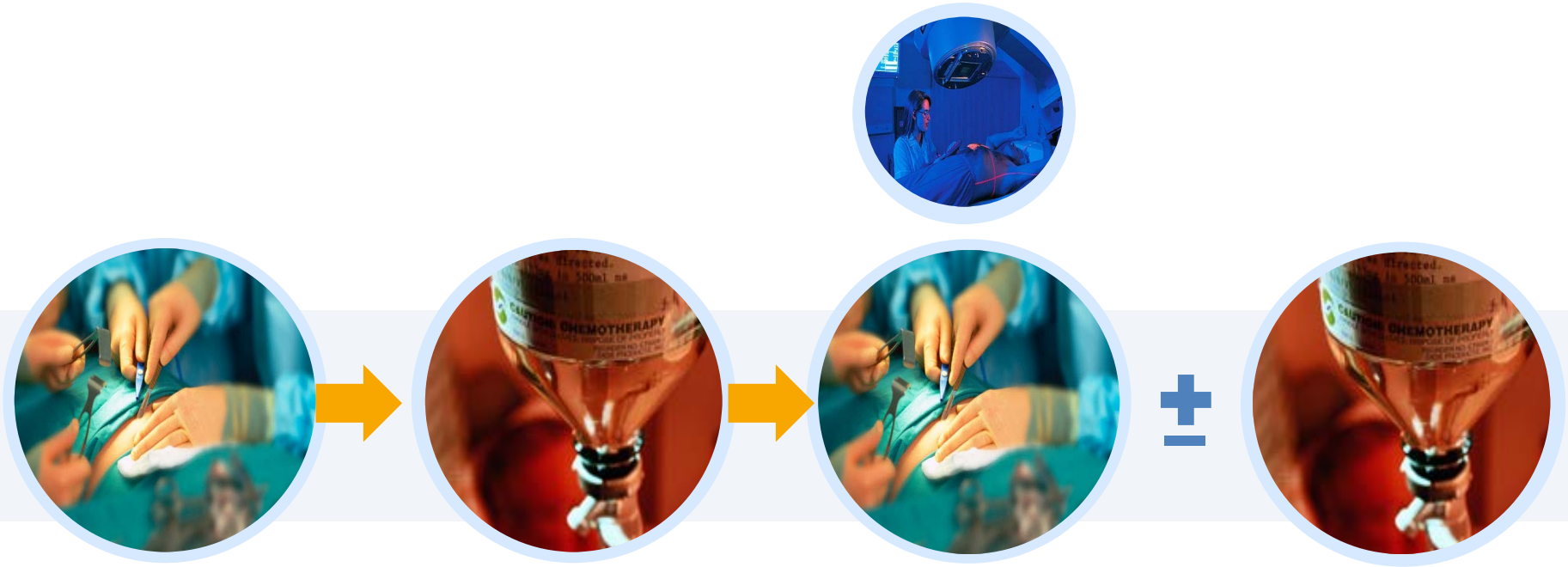
- CXR/CT/MRI primary site
- U/S (testis)
- Metastatic evaluation:
  - CT chest/Abd/pelvis
  - Bone scan
  - PET scan



- Tumor markers : AFP (YST), β-hCG (embryonal, CC)
- Peritoneal cytology : 25% positive esp. in ovarian tumor

Germ Cell Tumors

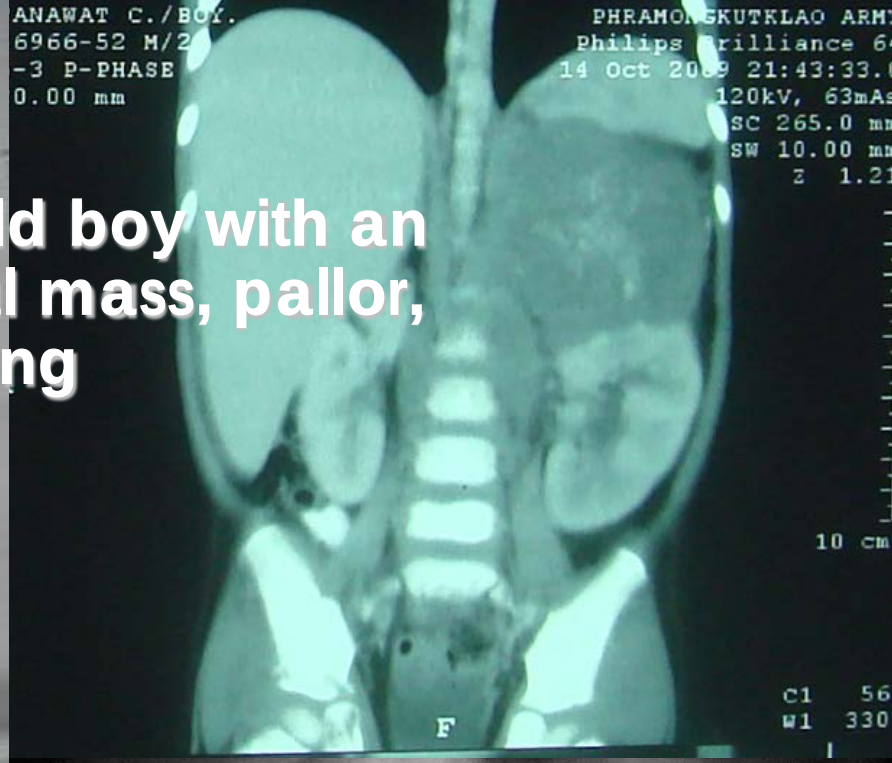
Treatment

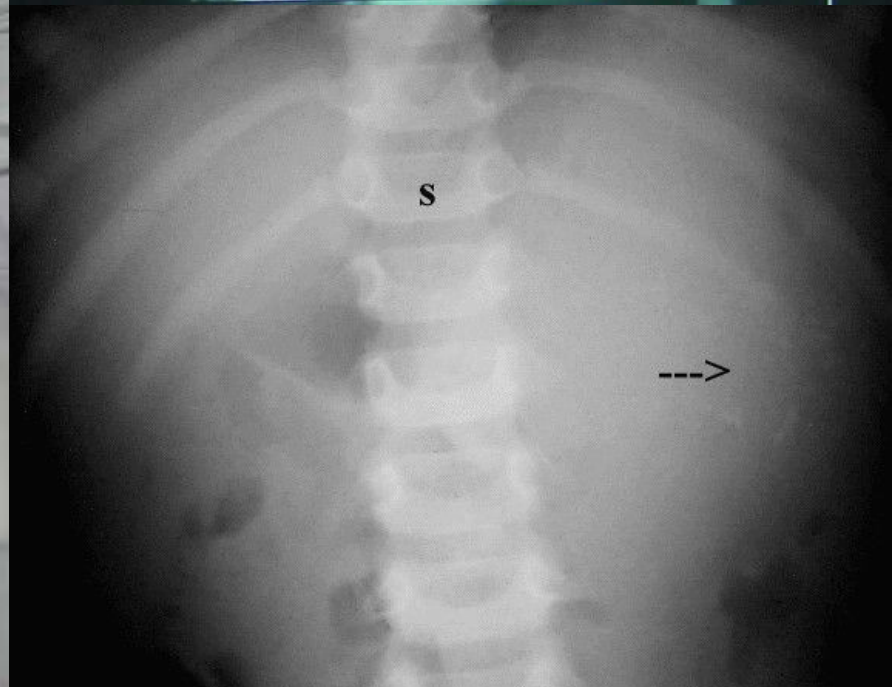


2nd Look Surgery

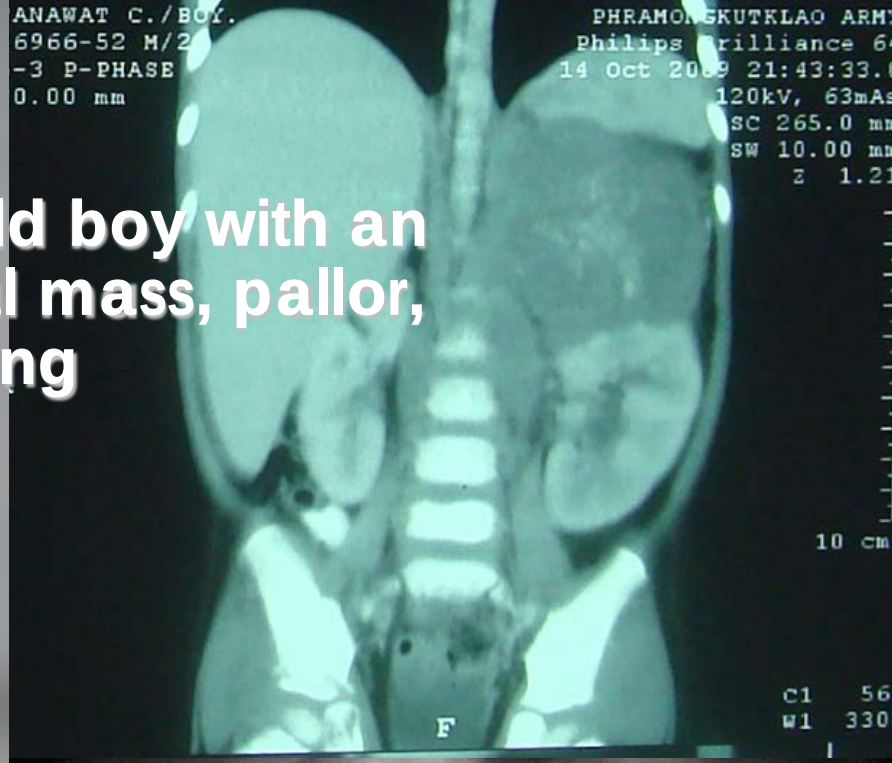
Sx RT Sx+RT

“1 year-old boy with an abdominal mass, pallor, ill-appearing



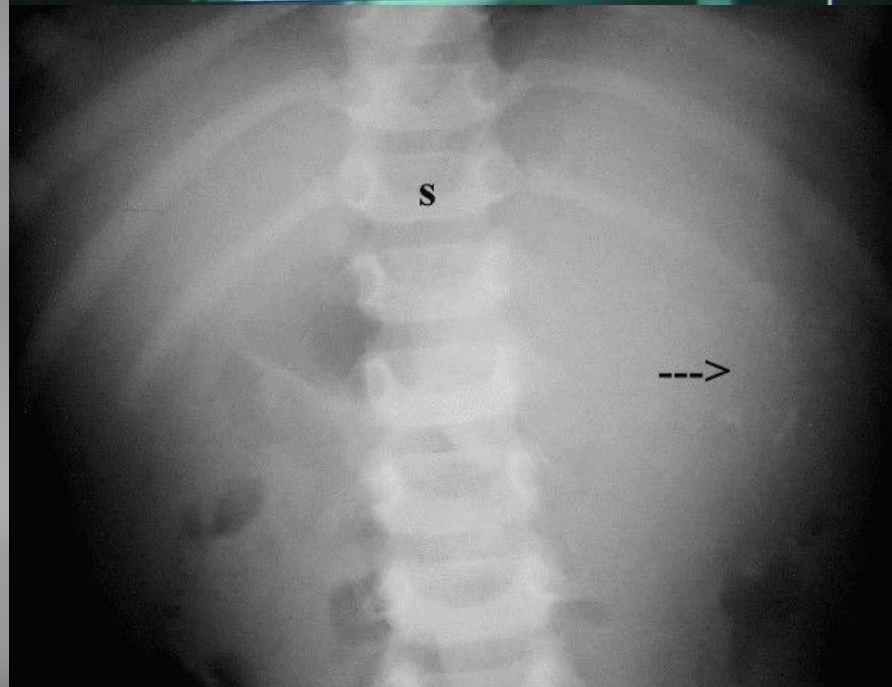


“1 year-old boy with an abdominal mass, pallor, ill-appearing

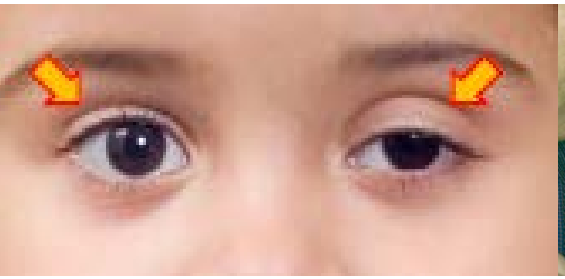


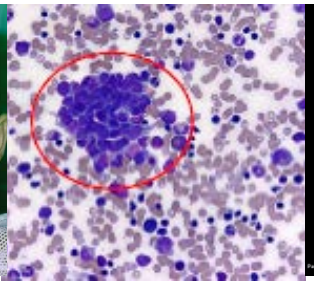
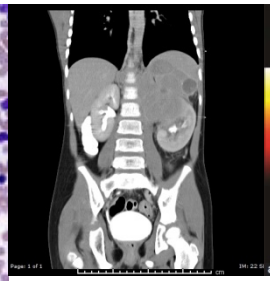
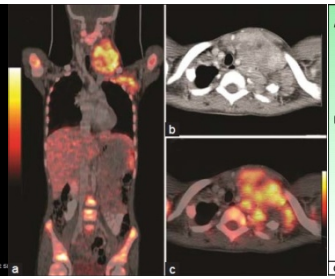
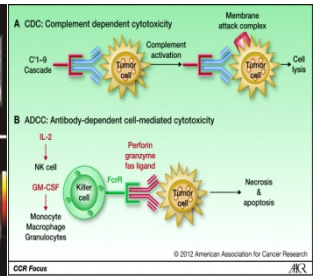
What is the most likely diagnosis?

A. Neuroblastoma
B. Wilms tumor
C. Malignant germ cell tumor
D. hepatoblastoma
E. Non-Hodgkin’s lymphoma

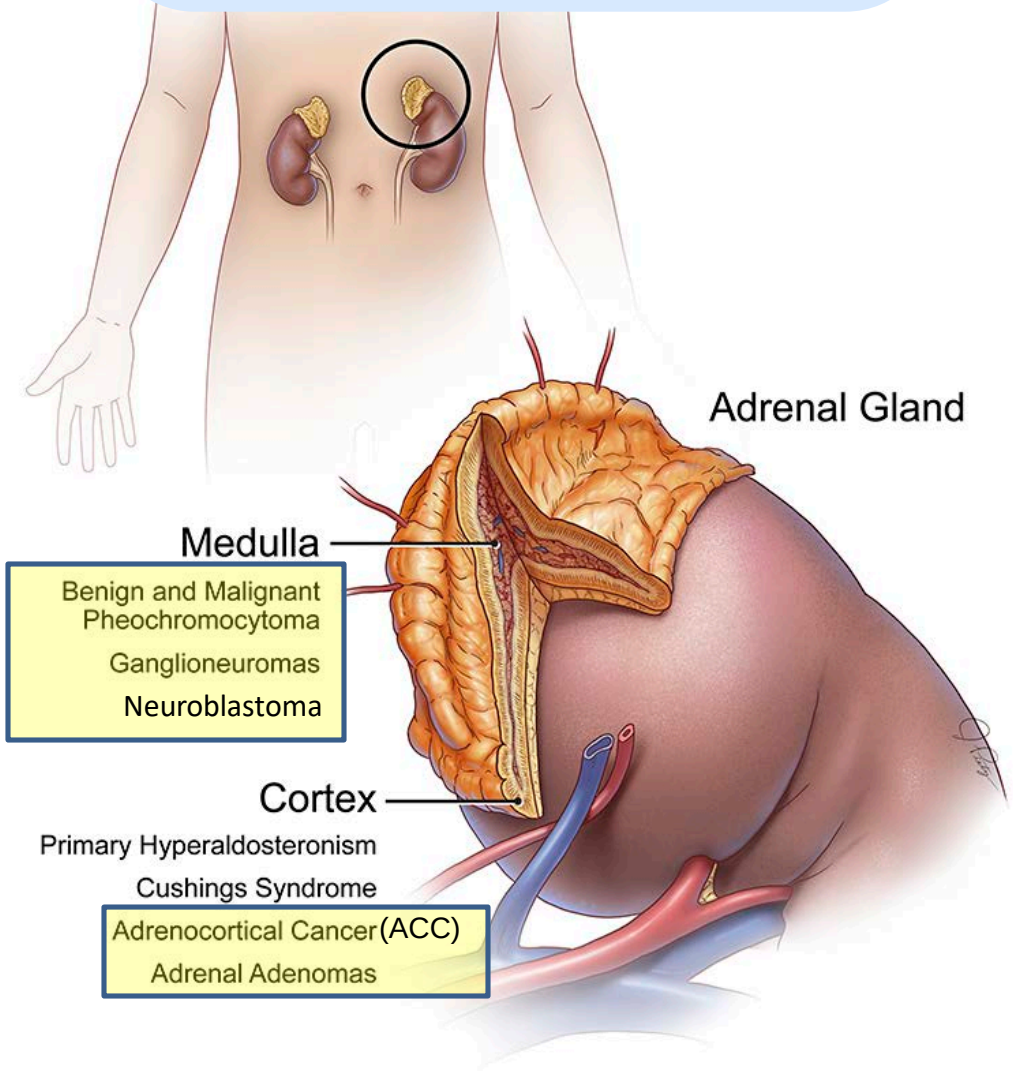


NEUROBLASTOMA



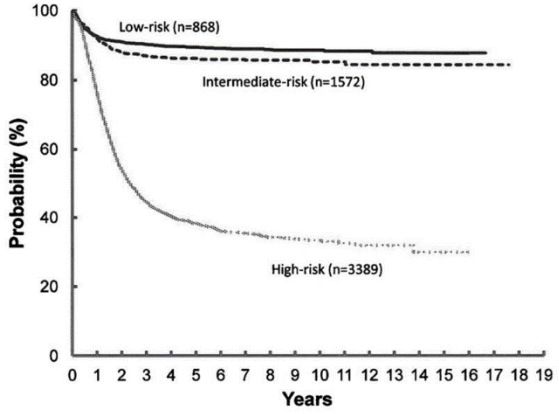
Adrenal Tumors



Neuroblastoma

Epidemiology

- MCM Extracranial malignant solid tumor in children
- Most frequent cancer diagnosis in infants 1/7,000 live births
- 7% of all cancer in children less than 15 yo
- Accounts of 15% of all pediatric cancer deaths
- ~50% present with HR disease



Park et al. Pediatr Blood Cancer 2013;60:985–993.

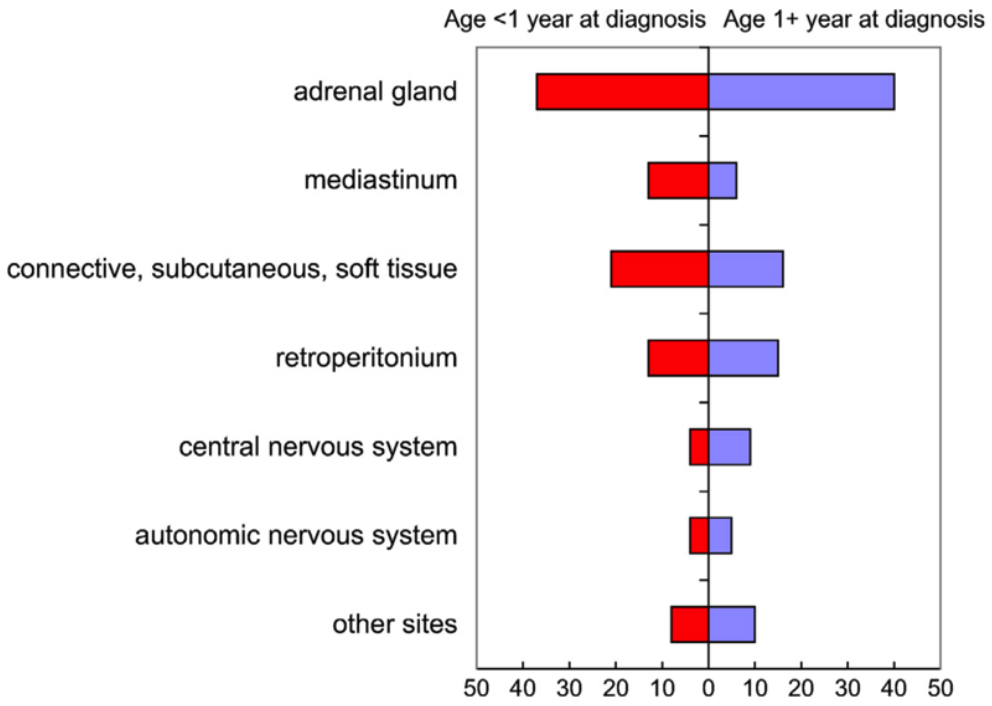
Neuroblastoma

Clinical Presentation

- Anywhere along sympathetic chain
- 50% with distant metastases (bone, bone marrow, liver)

Stage 4S in infants

- Typically favorable
- Can spontaneously regress
- Can be treated if symptomatic



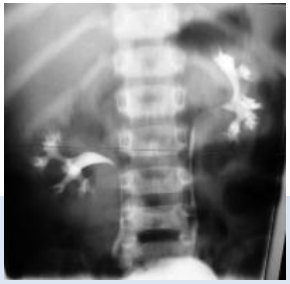
Irwin and Park. Pediatr Clin N Am 2015;62:225–256.

Neuroblastoma

Clinical Presentation

- Asymptomatic mass
  - Neck
  - Thorax
  - Abdomen
  - Pelvis
- Horner's Syndrome (cervical mass)
- Spinal Cord Compression (medical emergency)
  - Back pain
  - Neurologic deficits
- "Racoon eyes"
- Hepatomegaly
- Systemic symptoms
  - Weight loss
  - Irritability
  - Fever
  - Hypertension
  - Intractable diarrhea (VIP)
  - Opsoclonus/myoclonus
- Bone pain
  - Limp
  - Refusal to walk
- Pallor
- Skin lesions

Irwin and Park. Pediatr Clin N Am 2015;62:225–256.

Neuroblastoma	Wilm's Tumor
● Irritable child, tender	● Asymptomatic
● Abdominal mass : cross midline	● Abdominal mass : no cross midline
● Bimanual palpation : Negative	● Bimanual palpation : Positive
● Skin : blueberry muffin	● Hemihypertrophy, aniridia
● Eyes : raccoon eyes	● Ambiguous genitalia mental retardation
● Urinary metabolites	● HT , hematuria
● X-rays : stippled calcifications 	● GU anomalies, Beckwith-Wiedemann syndrome
● IVP : Drooping-lily	● CT/IVP : Claw

Neuroblastoma

Investigations

- Urine catecholamine (VMA, HVA)
  *increased up to 78% and 83%, respectively**
- Serum NSE (non-specific)
- Imaging : plain films, U/S, CT, MRI
- Nuclear medicine
  - Bone scans
  - MIBG scans *positive up to 90% of cases*
  - PET scans
- Bilateral BMA, BM biopsy
- Tissue biopsy

Irwin and Park. Pediatr Clin N Am 2015;62:225–256.

Neuroblastoma

Diagnosis

- Tissue diagnosis is definite

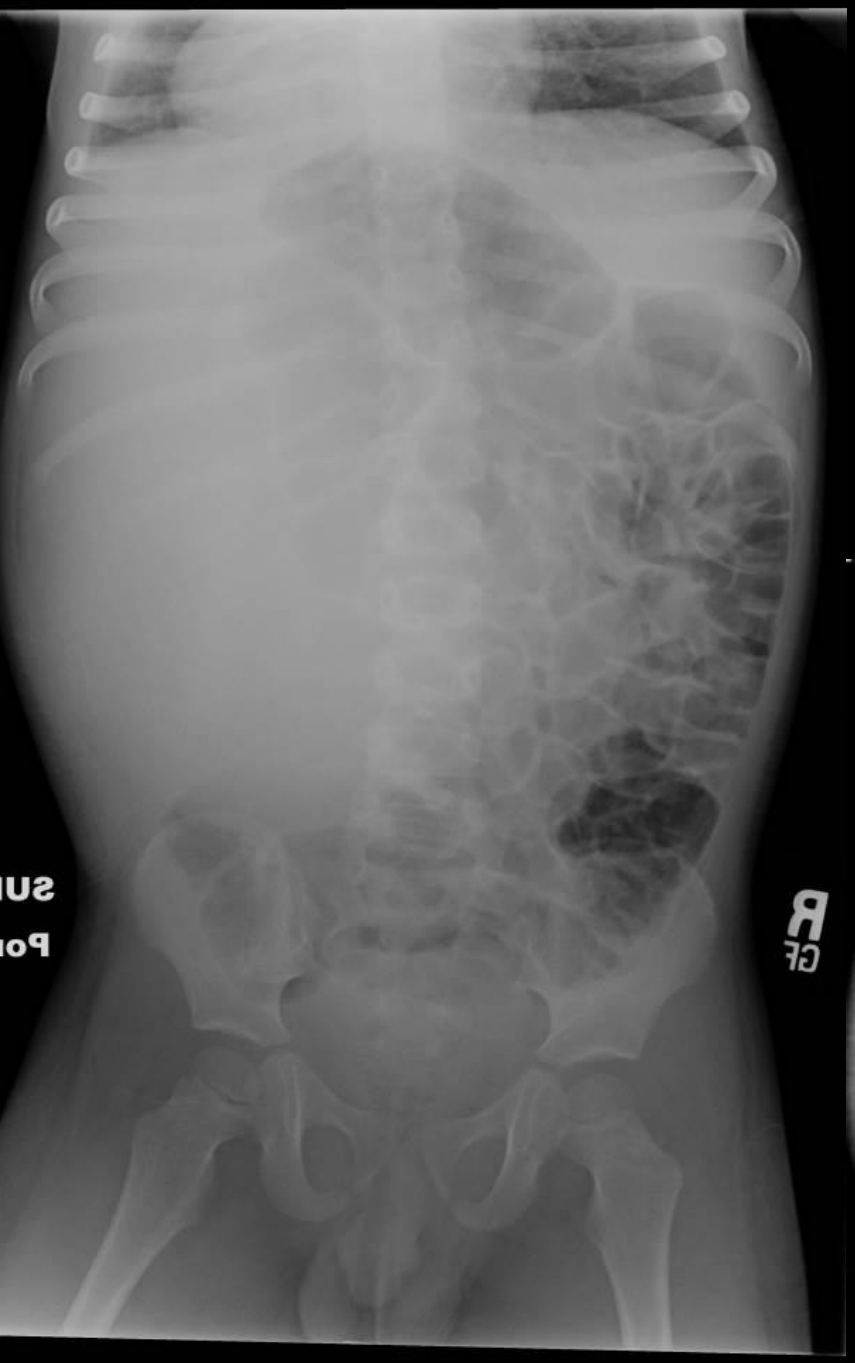
- Bone marrow aspirate positive for pseudo-rosette formation, small round blue cell + Elevation of Urine catecholamine

With clinical support

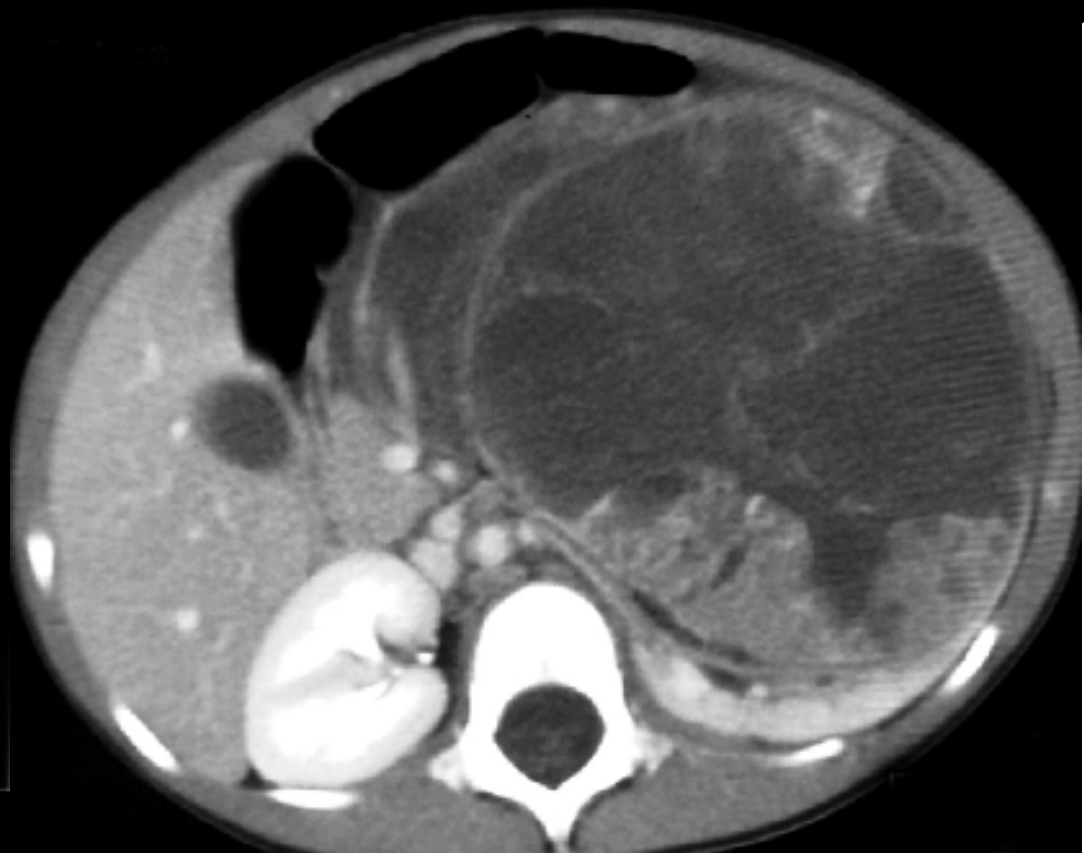
NSE=*Non-specific* enolase
Also positive in other NE tumors, EWS, germinomas, WT

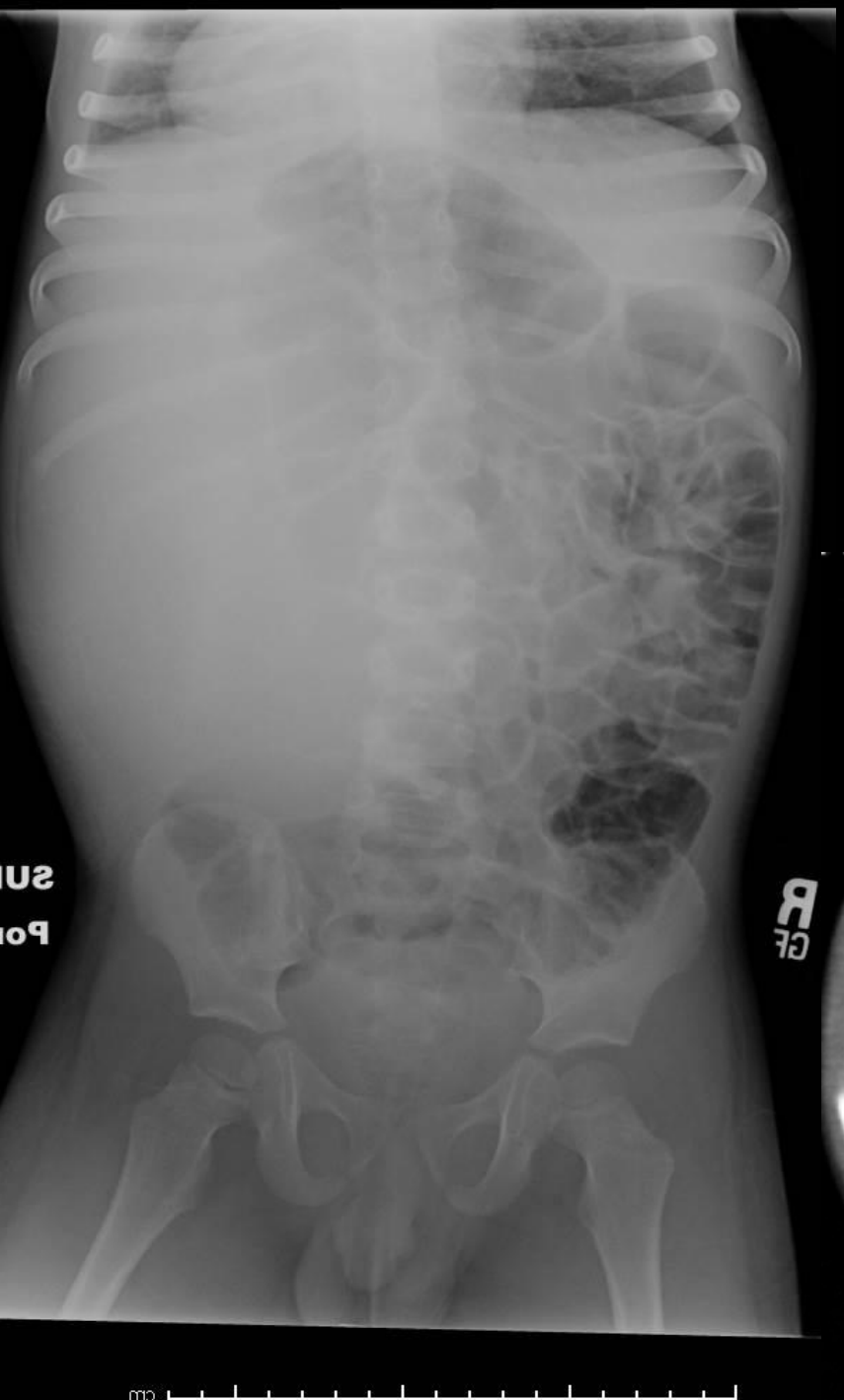
Neuroblastoma

Treatment



"2 Years-old boy with an asymptomatic abdominal mass and hypertension"





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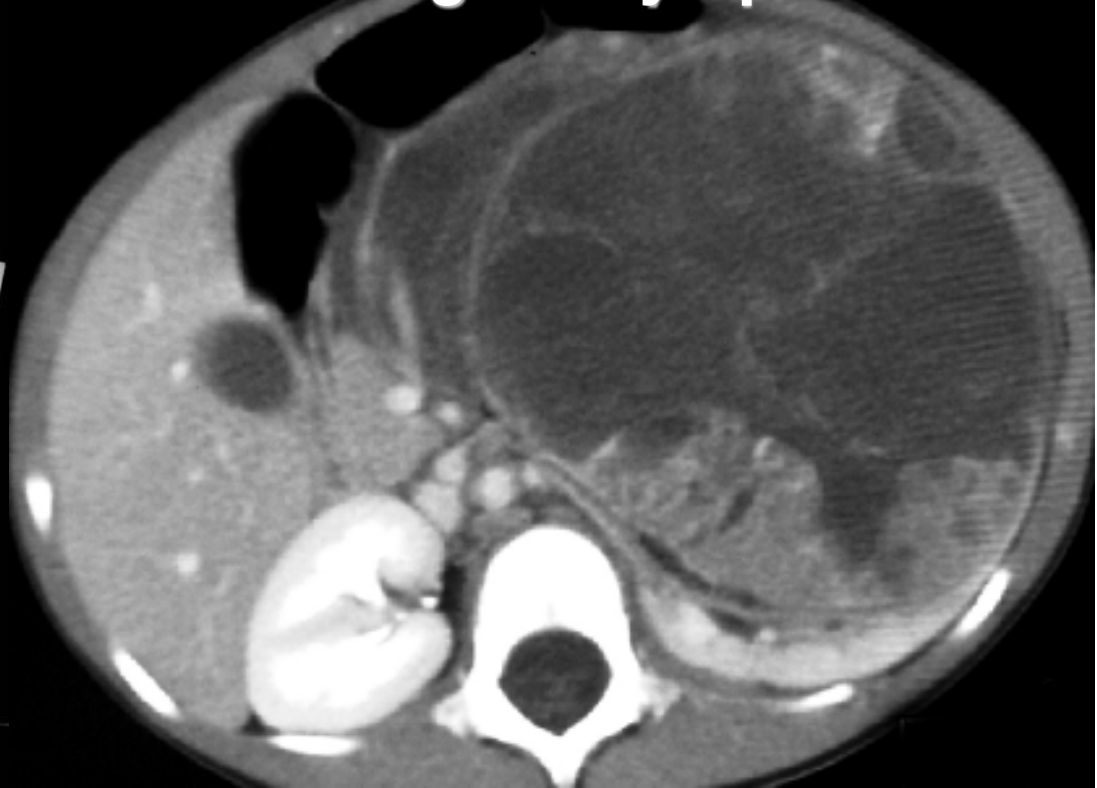
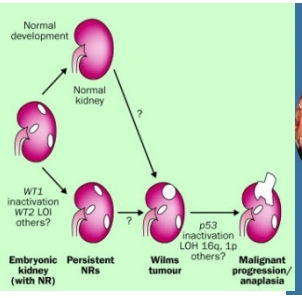
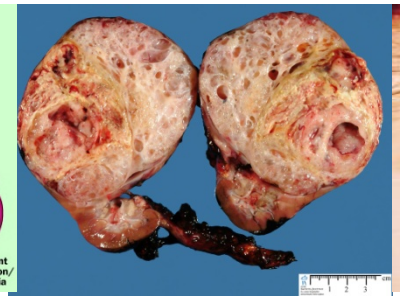
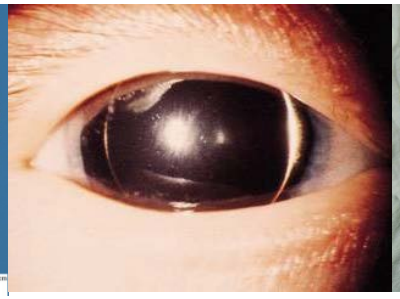
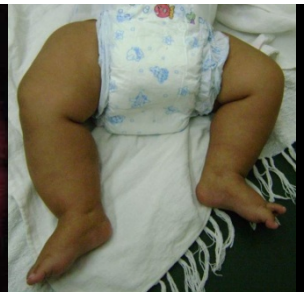
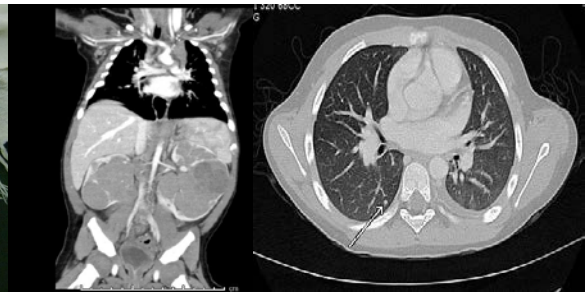
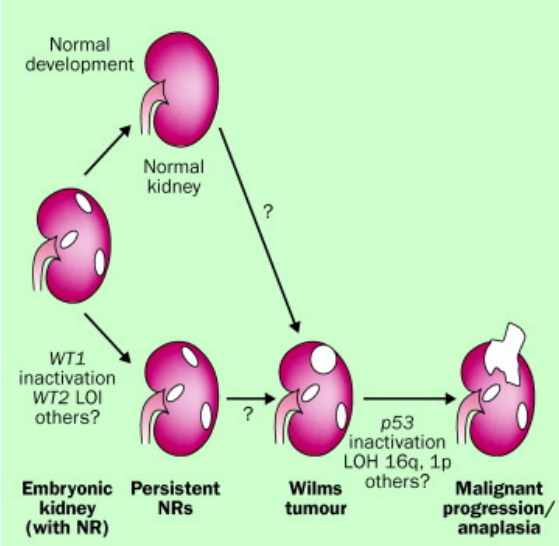


WILMS' TUMOR


Normal development
Normal kidney
?
WT1 inactivation WT2 LOI others?
?
p53 inactivation LOH 16q, 1p others?
Embryonic kidney (with NR)
Persistent NRs
Wilms tumour
Malignant progression/ anaplasia





Wilms' tumor

- MCM renal malignancy
- Peak age 3-4 years
- Embryonal neoplasm arising in kidneys

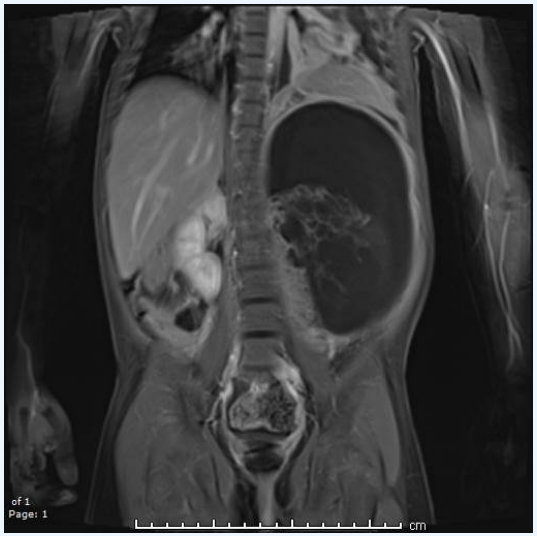


Kalapurakal et al.,Lancet Oncol 2004; 5: 37–46

Wilms' tumor

Signs & Symptoms

- A symptomless abdominal mass 60%
- Hematuria 30%
- HT 25%
- Polycythemia
- Acquired vWD <10%

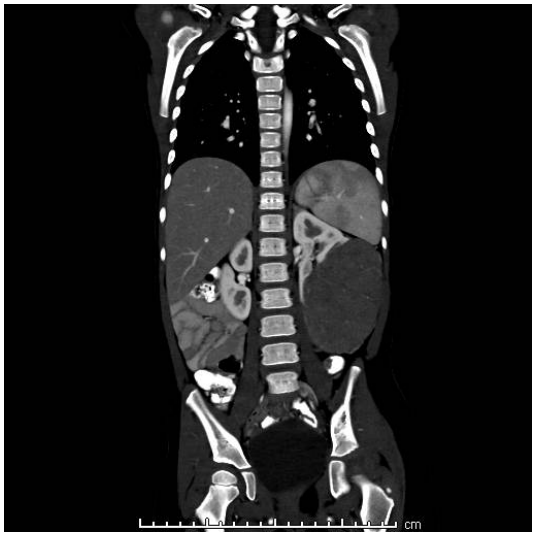


Wilms' tumor

Investigations

- U/A
- BUN/Cr
- Coagulogram and bleeding time : acquired vWD

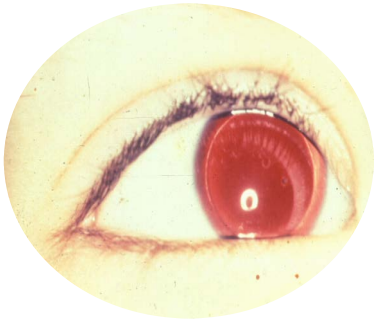
- U/S, CT scan
- CXR, CT chest



- BMA: Not necessary unless + evidence of BM invasion

Wilms' tumor

Associated congenital anomalies



- 13-28%
- Beckwith – Wiedemann syndrome
- WAGR syndrome

  (Wilm's tumor, aniridia, GU anomaly, retardation)
- Denys-Drash syndrome:undermasculinized reproductive organs in boys, gonadoblastoma, end-stage renal disease (diffuse mesangial sclerosis)

Kalapurakal et al.,Lancet Oncol 2004; 5: 37–46

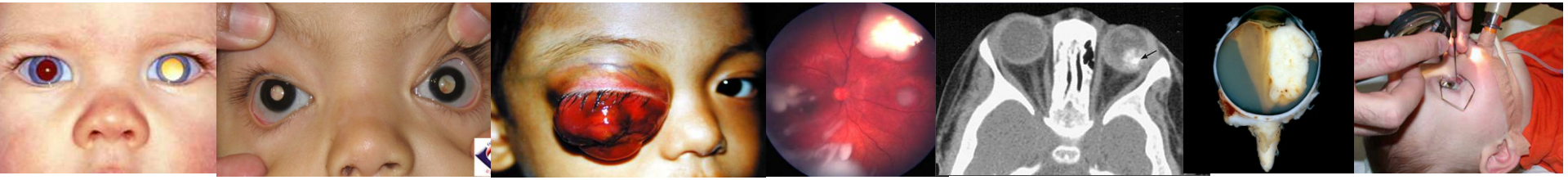
Wilms' tumor

Principle of the treatment

Except bilateral WT

“2 months-old girl, mom noticed abnormal on photo she has taken”

RETINOBLASTOMA



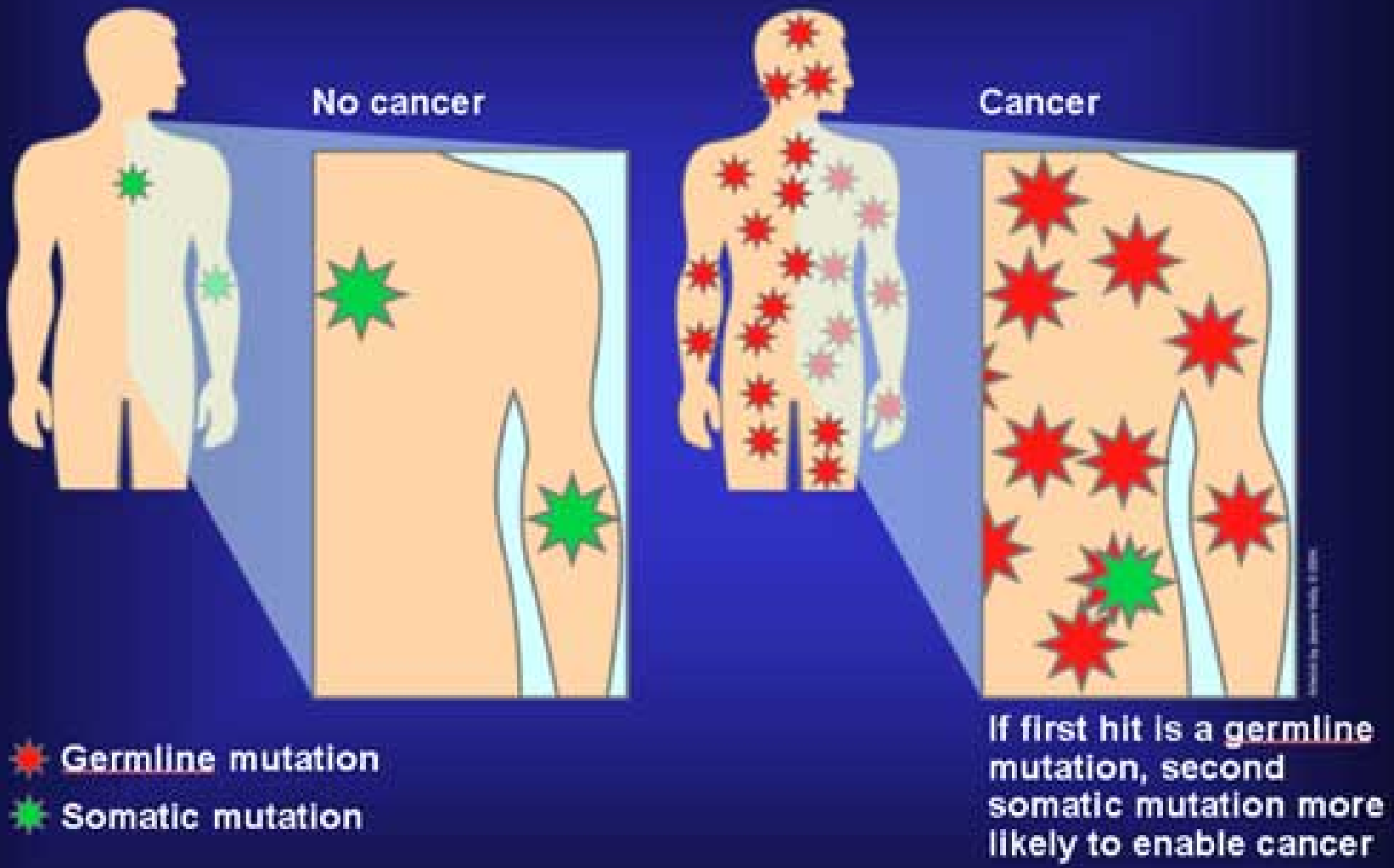
Pediatric Hematology-Oncology
Pramongkutklao Hospital

Retinoblastoma

Epidemiology

- Malignant tumor of retina
- MCM primary intraocular malignancy of childhood
- MCM occur < 2 yr of age
- Mutation in tumor suppressor gene retinoblastoma gene (RB 1 gene)
  - Germ cell mutation → Hereditary 40%
  - Somatic cell mutation → Non – Hereditary 60%
- Survival rate > 90%

Two-Hit Hypothesis



First hit is germline in heritable form and somatic in sporadic non-heritable form

Retinoblastoma

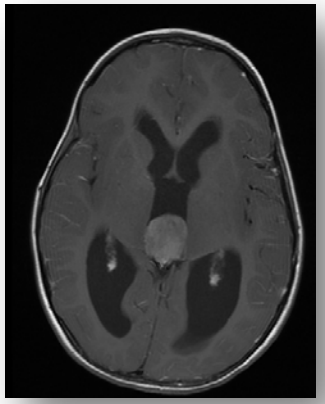
Clinical Presentations

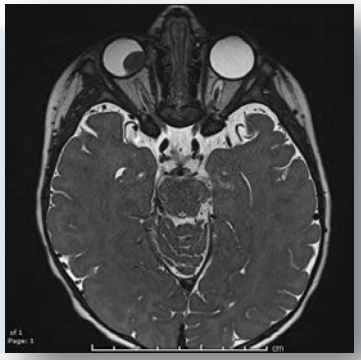
- Leukocoria : MCM
- Strabismus
- Painful, red eye
- Proptosis
- Trilateral retinoblastoma
- Metastasis :
  - Soft tissue extension
  - Hematogenous : brain, liver, BM, bone

Retinoblastoma

Investigations

- EUA (Examination Under Anesthesia) by opthalmologist
- MRI brain with orbit Bone scan
- BMA and biopsy
- CSF studies if suspected CNS disease

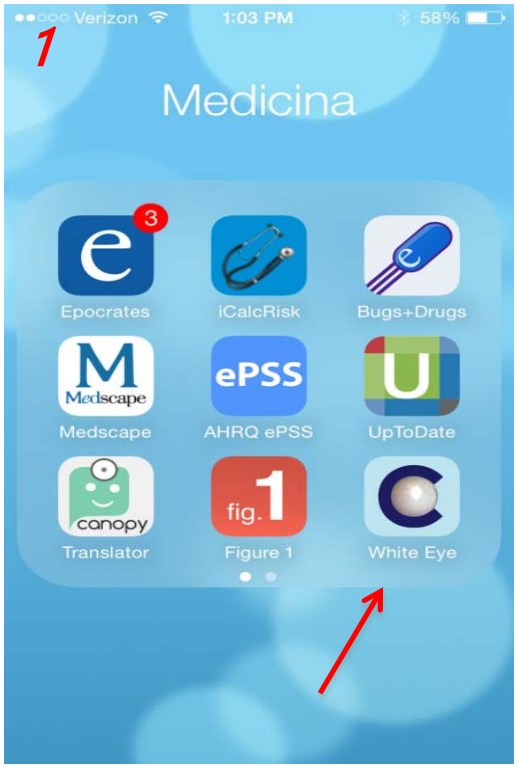




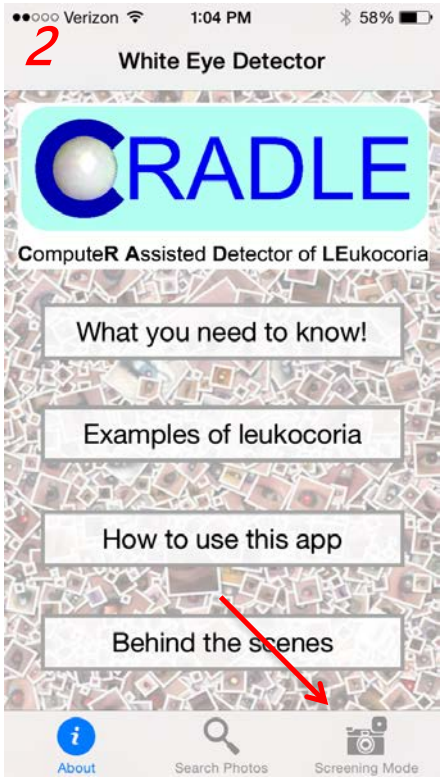
Diagnosis made during EUA
Pathology not necessary

CRADLE

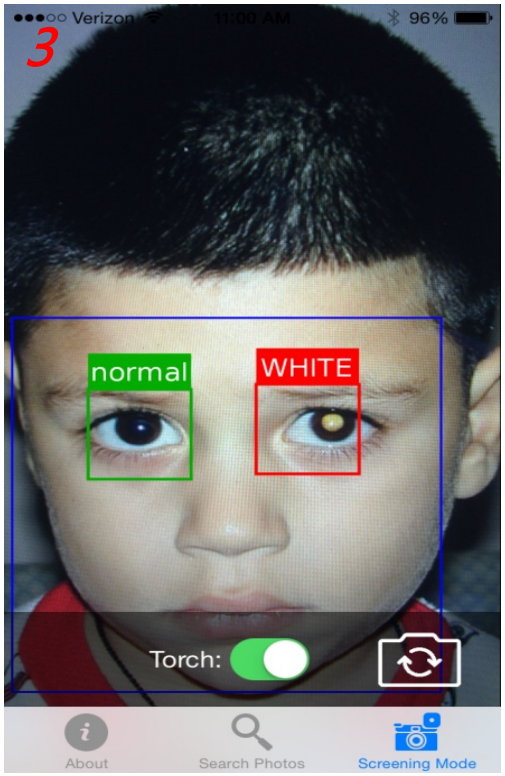
ComputeR Assisted Detector of LEukocoria



Open the App White Eye



Choose the option "Screening Mode."



Pediatric Hematology-Oncology
Pramongkutklao Hospital

Nitin Shrivastava
Alex Power-Hays

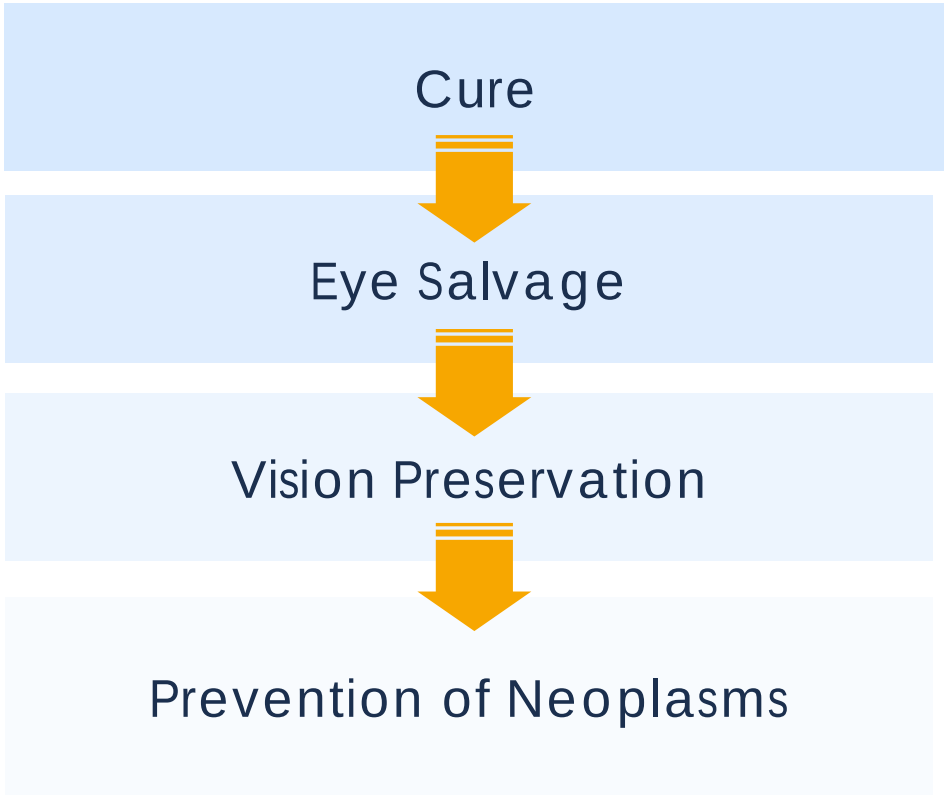
Retinoblastoma

Treatment

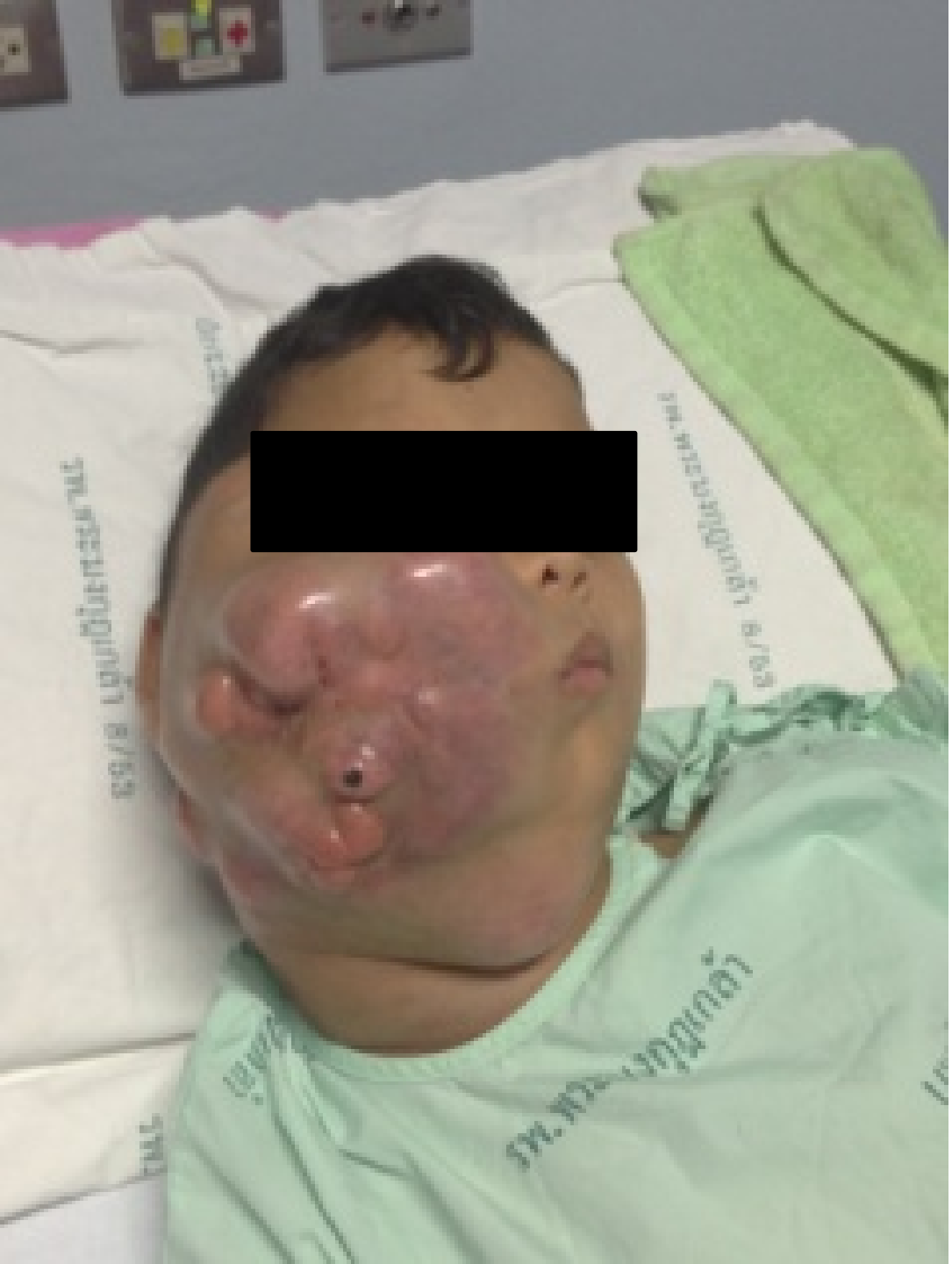
Multidisciplinary Team

- Pediatric Oncologist
- Ophthalmologist
- Radiation Oncologist
- Infrastructure
- Supportive care

Priorities in Treatment



Carlos Rodriguez-galindo, M.D. (with permission)

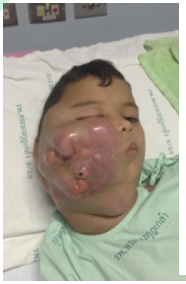


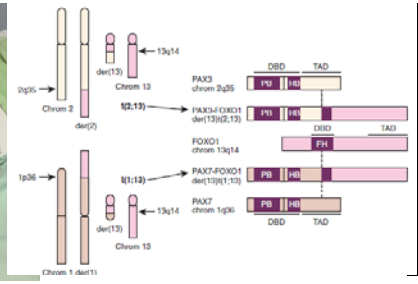
"8 years-old boy
with
growing mass"

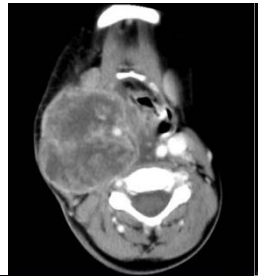
What is the most likely diagnosis ?

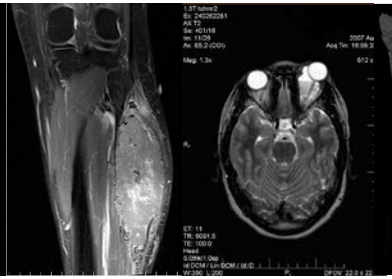
A. Rhabdomyosarcoma
B. Neuroblastoma
C. Langerhans cell histiocytosis
D. Burkitt lymphoma

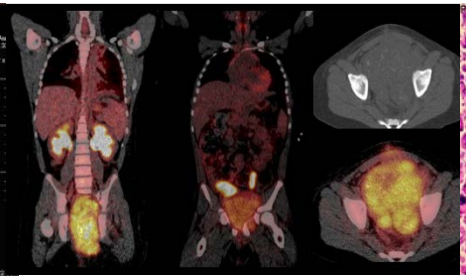
RHABDOMYOSARCOMA

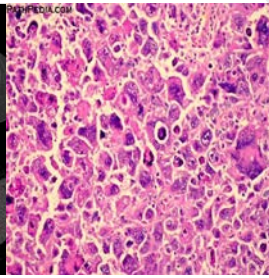










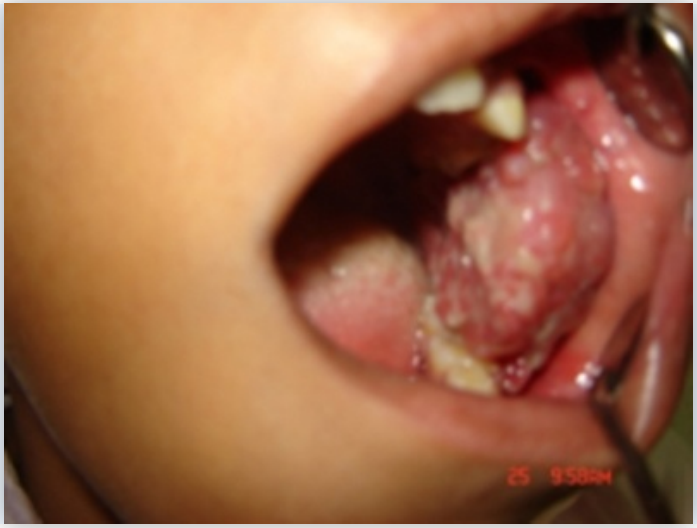


Pediatric Hematology-Oncology
Pramongkutklao Hospital

Rhabdomyosarcoma

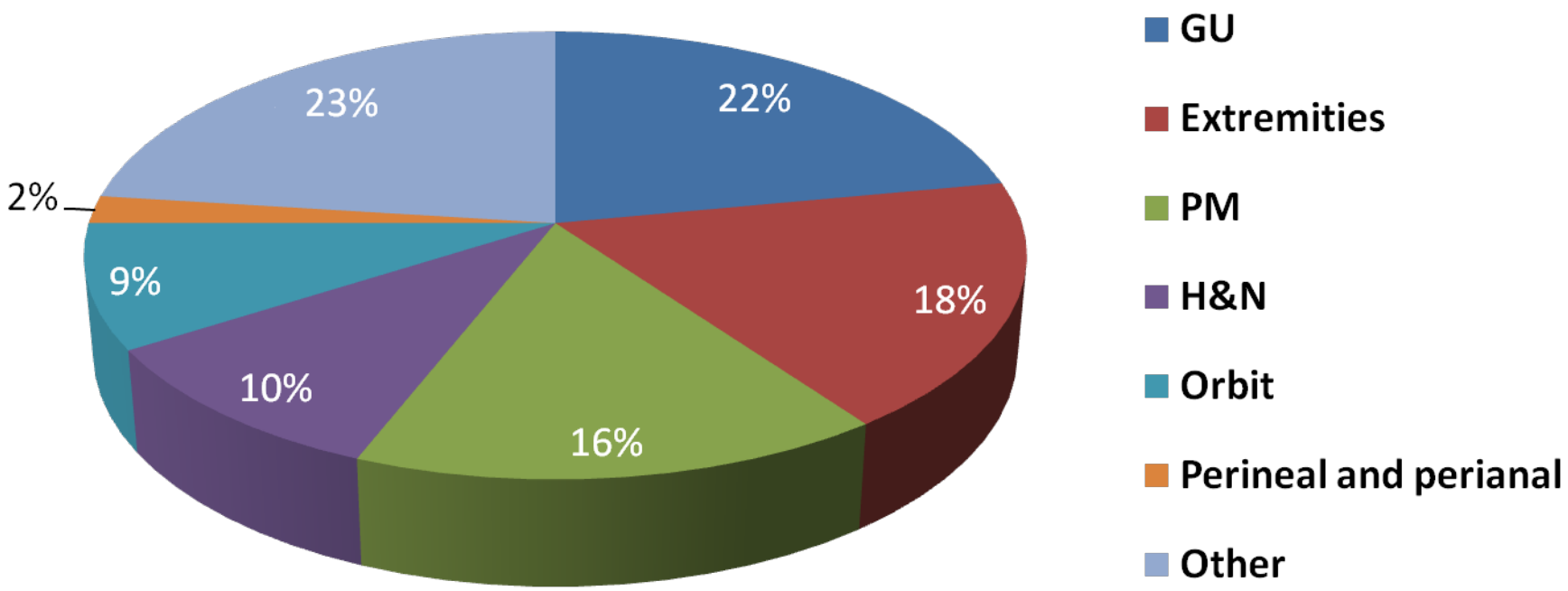
Epidemiology

- Soft tissue tumor of mesenchymal origin
- Incidence: 4.5/1 million children
- 6-8% of all childhood cancers



Rhabdomyosarcoma

Primary Sites



Rhabdomyosarcoma

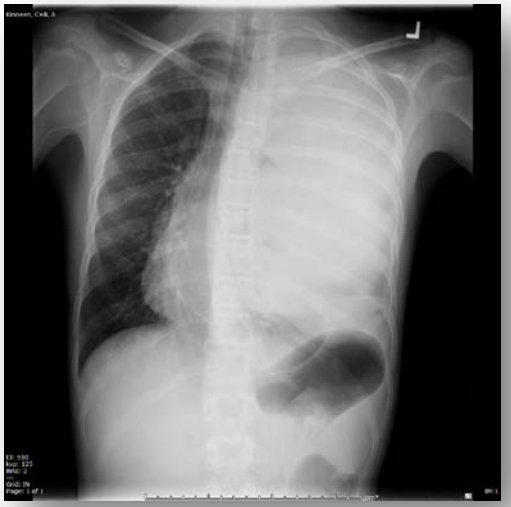
Disease Characteristics

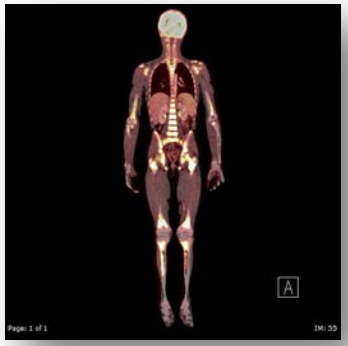
Primary site	Frequency (%)	Symptoms and signs	Predominant pathologic subtype
Head and neck	35	Proptosis	Embryonal
Orbit	9	Cranial nerve palsies; aural or sinus obstruction +/- drainage	
Parameningeal	16	Painless, progressively enlarging mass	
Other	10		
Genitourinary	22	Hematuria, urinary obstruction	Embryonal (botryoid variant in bladder and vagina)
Bladder and prostate	13	Pelvic mass, grape liked mass, vaginal discharge	
Vagina and uterus	2	Painless mass	
Paratesticular	7		
Extremities	18	Affects adolescents; swelling of affected body part	Alveolar (50%)
Perineal and perianal (PRMS)	2	Mass	Alveolar (60-80%)
Other	23	Mass	Embryonal, alveolar

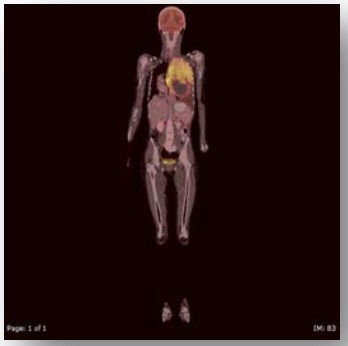
Rhabdomyosarcoma

Investigations

- CT/ MRI primary lesion
- CT chest, CXR
- CT abdomen include pelvis
- Bone scan
- PET scan
- BMA & BM biopsy
- Biopsy
  - ARMS with extremities lesions → sentinel LN Bx

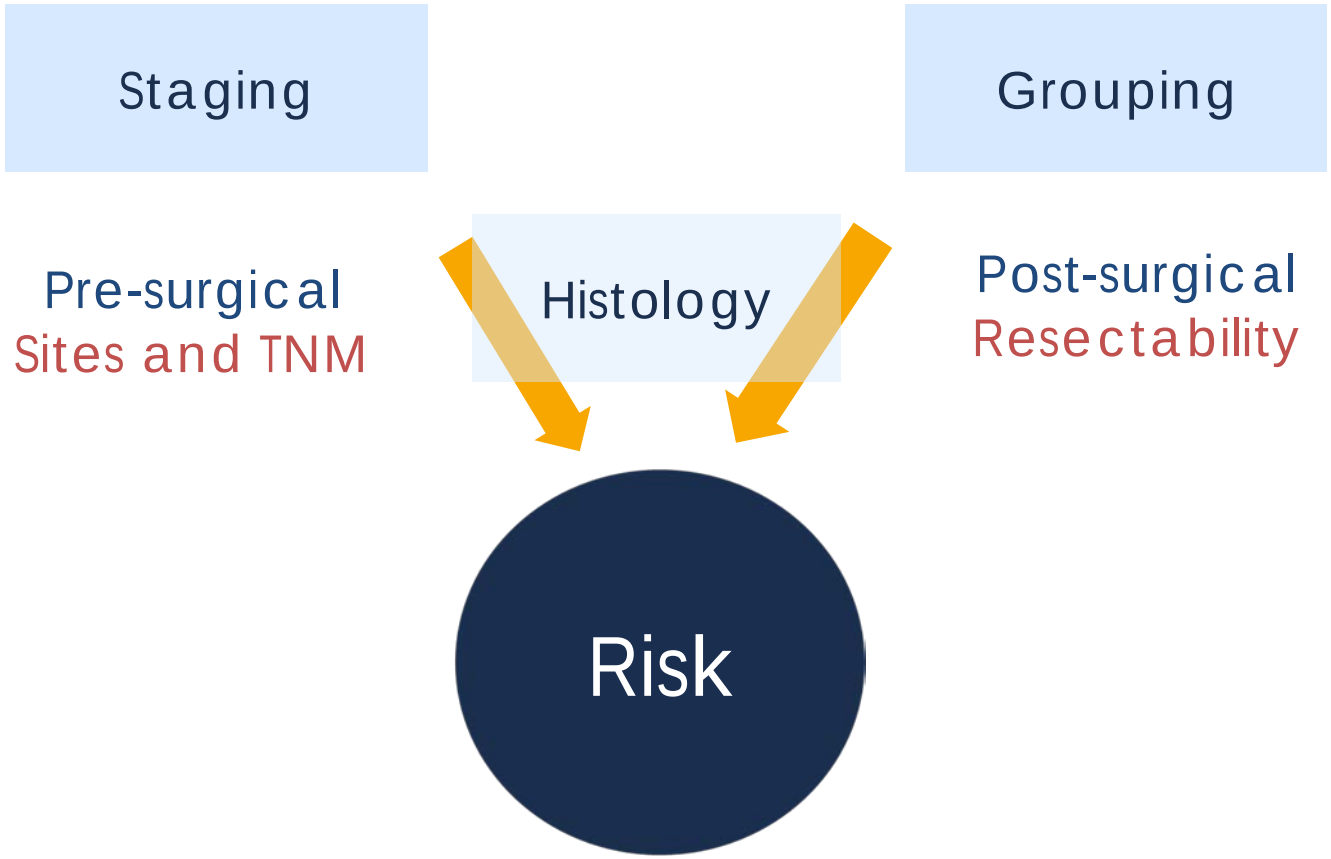


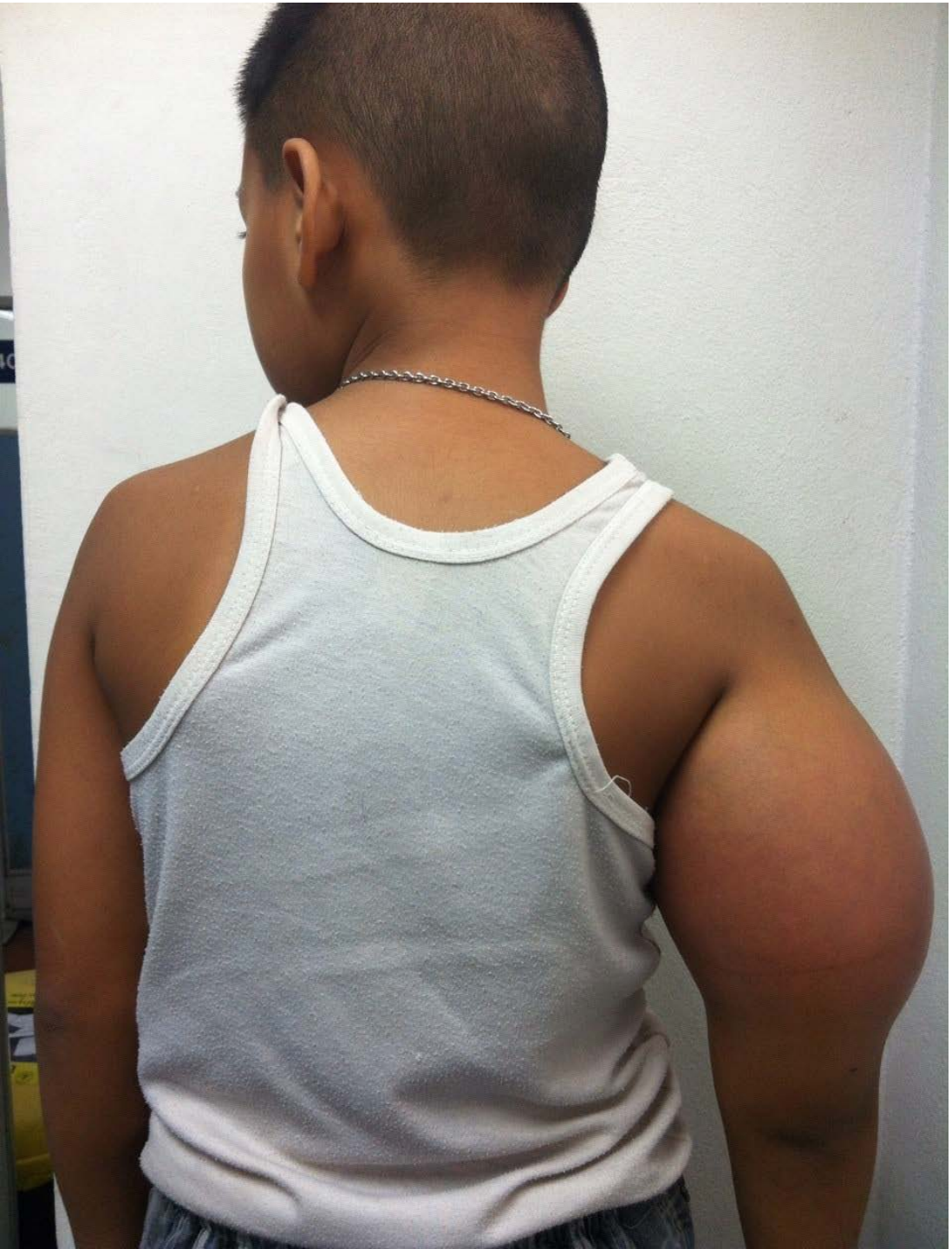




Rhabdomyosarcoma

Risk Stratification



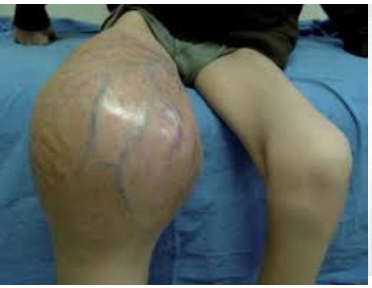
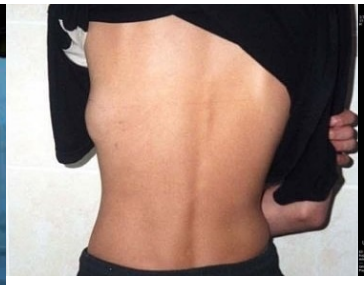
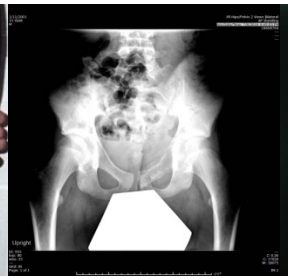
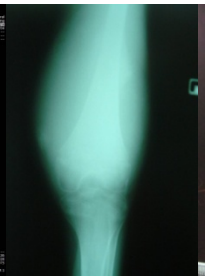
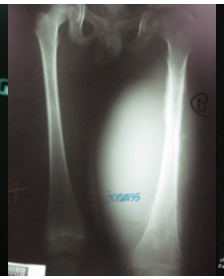
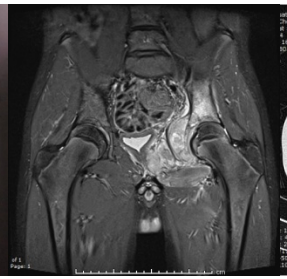
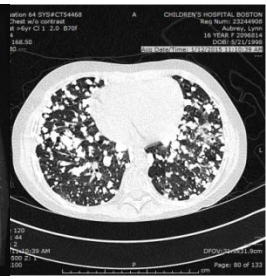


“9 years-old boy with growing mass and pain ”

What is the most likely diagnosis ?

A. Ewing’s sarcoma
B. Osteosarcoma
C. Rhabdomyosarcoma
D. Hemangioma
E. Lymphoma

MALIGNANT BONE TUMORS

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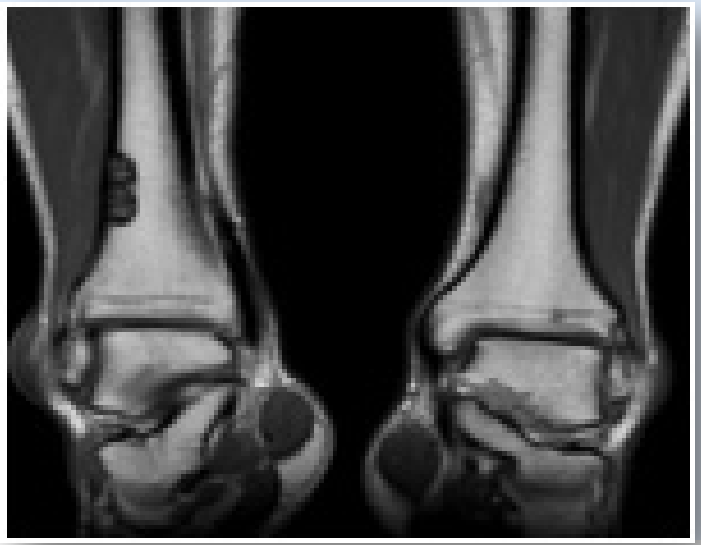
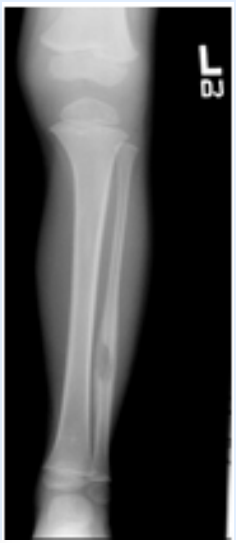
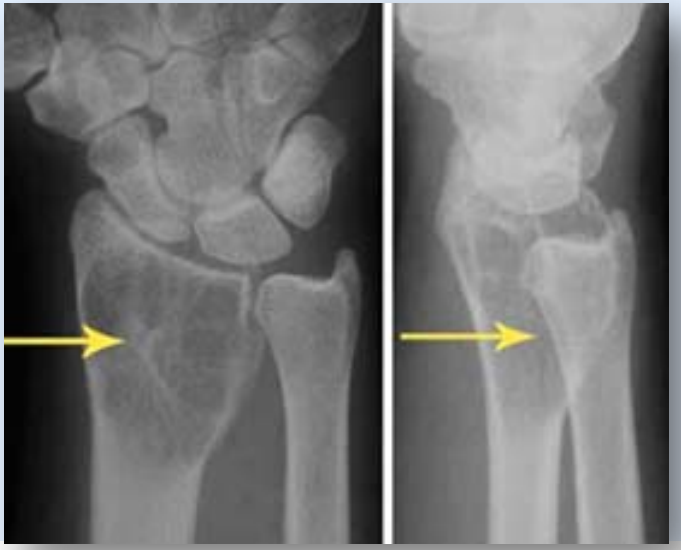
Bone Tumors in Children

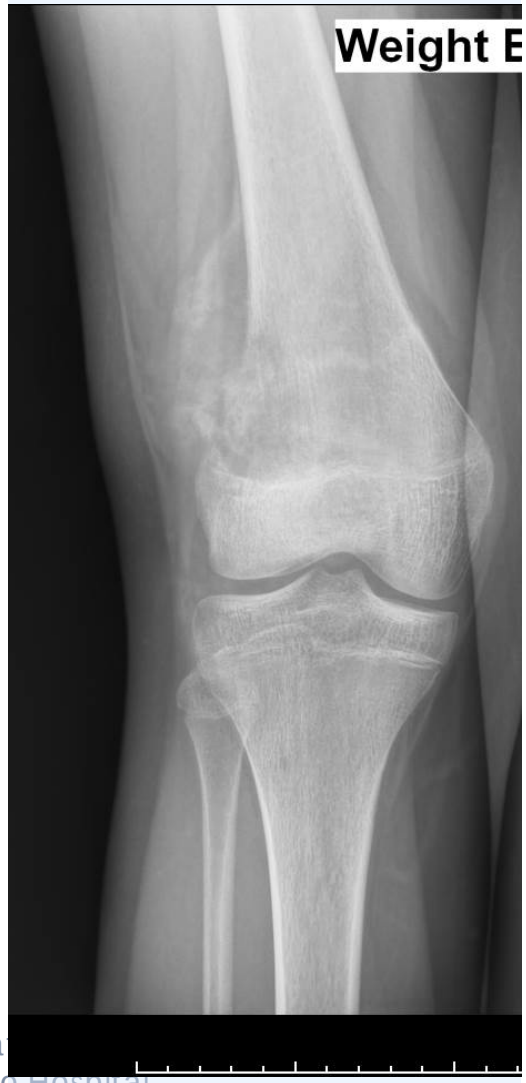
- Only half of bone lesions in children are malignant
- Other half benign or nonneoplastic lesions



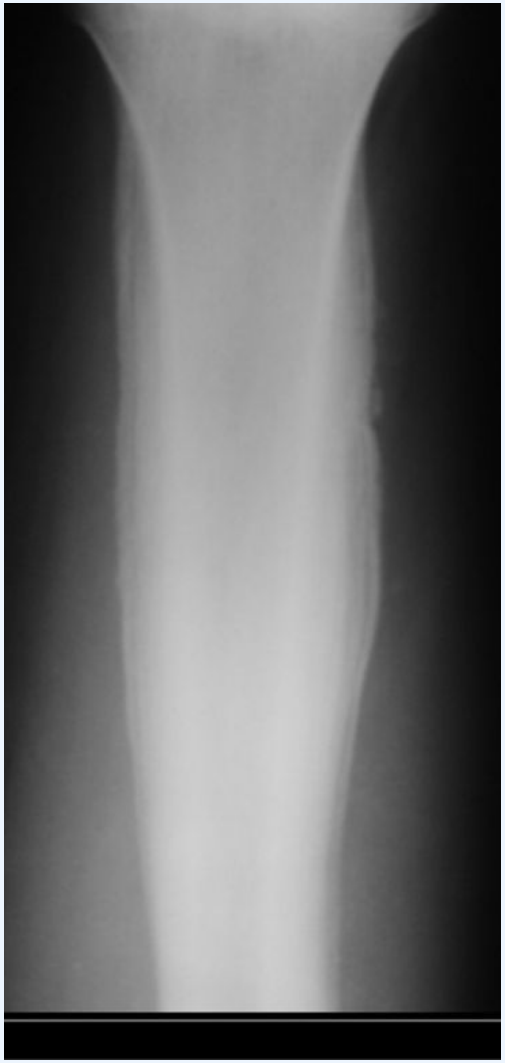




Osteosarcoma



Ewing sarcoma



Malignant Bone Tumors

	Osteosarcoma	Ewing's Sarcoma
Age		
< 5yr	Very rare	Common
Adolescent	Peak	Peak
Adult > 40 yr	Yes	Very rare
Race	Asian> Caucasian	Caucasian>>>>>>> Asian
History		
Previous RT	Yes	No
Family Hx	LFS, RB1	No
Constitutional symptoms	No	Yes
Location	Bone	Bone, soft tissue, renal
Skip lesion	Uncommon	Common
Metastasis	Lung	Lung, bone, BM

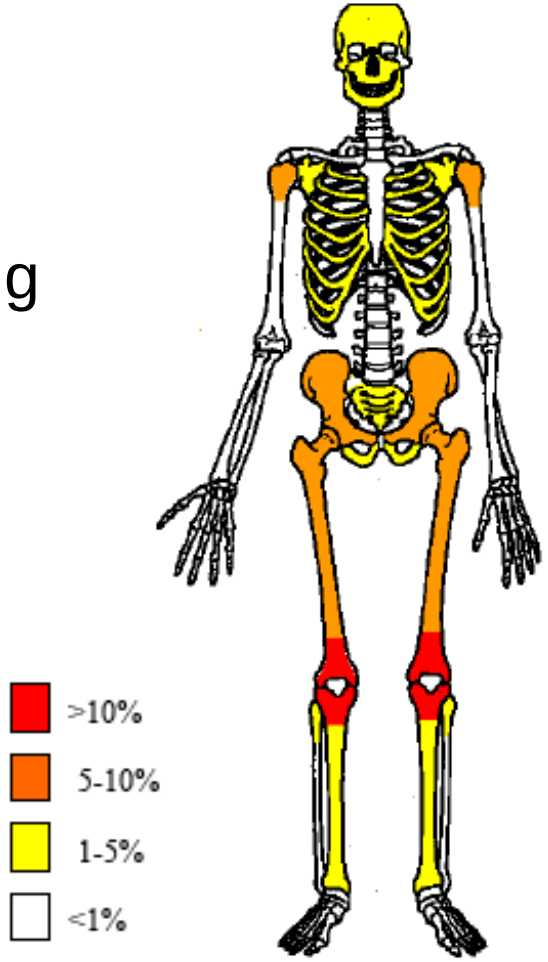
Malignant Bone Tumors

	Osteosarcoma	Ewing's Sarcoma
Bone	Long bones	Long and Flat bones (Pelvis, skull, ribs)
Site	Metaphysis	Diaphysis
Genetic	p53 gene mutation	Oncogene activation (EWS)
Radiologic findings	• Sunburst pattern • Calcification • Periosteal reaction • Codman's triangle	• Moth-eaten lytic lesion • Onion skin
LAB	↑ALP CBC-normal	Normal ALP CBC-abnormal (if BM+)
PATH	Malignant spindle cell Malignant osteoid +	Small round blue cell No malignant osteoid
RT	Resistance	Responsive

Osteosarcoma

Clinical Presentation

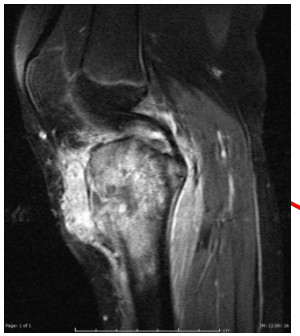
- Local pain (90%)
- Local swelling (50%)
- Decreased range of motion, limping (45%)
- Pathologic fracture (8%)
- Lab
  - Elevated LDH 30%
  - Elevated ALP 40%

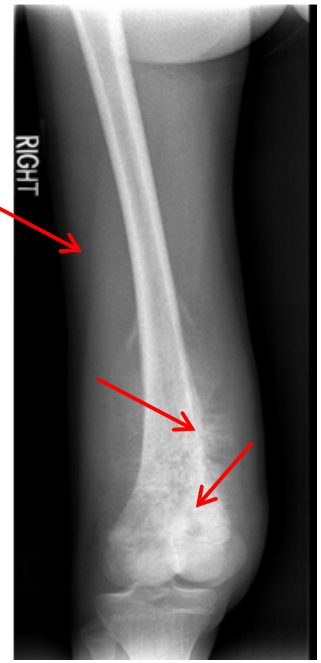


Osteosarcoma

Investigations

- Plain film at primary and bone met site(s)
- CXR
- MRI of primary tumor
- CT chest
- Bone scan
- PET scan: (recommend) evaluation for metastatic disease (bone, lung)
  - PET/CT more sensitive and accurate than bone scan*
  - Combined use improves sensitivity*
- Biopsy
  - Requires planning for later resection of biopsy tract



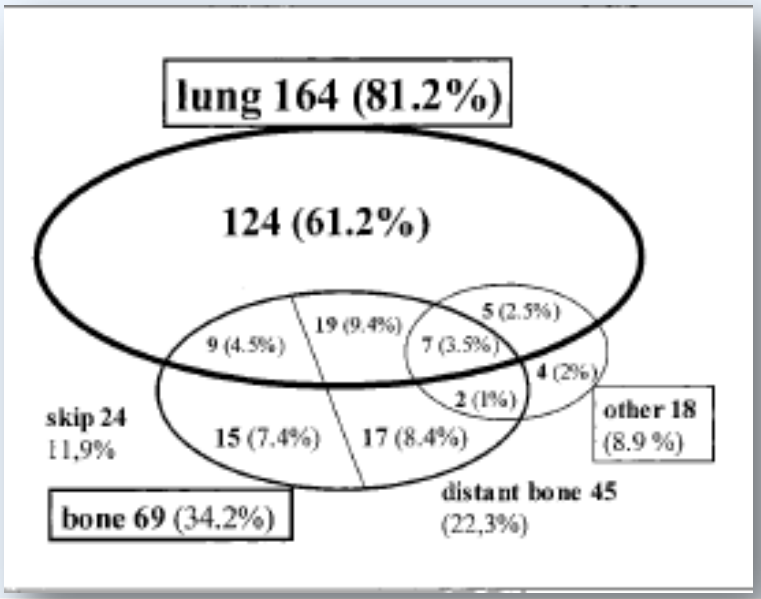


*Byun BH et al, Skeletal Radiol 2013
Meyer et al., Pediatr Blood Cancer 2008;51:163–170

Osteosarcoma

Staging

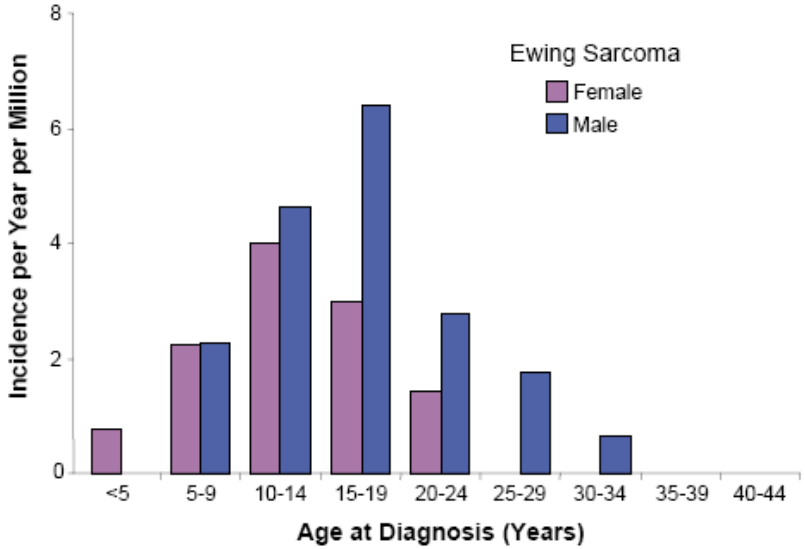
- Localized
- Metastatic
  - 15-20% metas at presentation
  - Lungs
  - Bone:
    distant and skip lesions
  - Combined



Kager L et al. J Clin Oncol 2003

Ewing Sarcoma Family of Tumors (ESFT)

- Majority present in the 2nd decade of life
- 2nd MCM bone malignancy in children
- Bone, soft tissue, Askin's tumor or PNET
- Metastasis: 25% of patients present with metastases
  - Lung 38%
  - Bone 31%
  - BM 11%
  - Other unusual sites

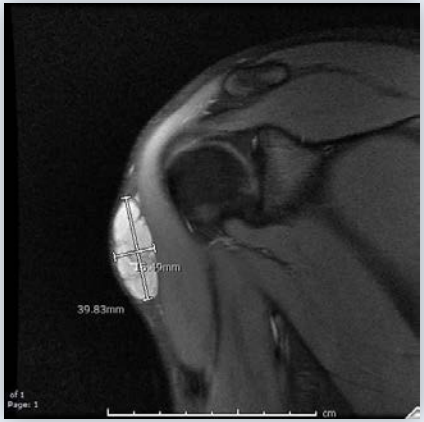


Mascarenhas et al., 2006
SEER Data 1975-1999

ESFT

Clinical Presentation

- Age: median age 15 years
- Race: significant higher incidence in Caucasians
- Presenting symptoms
  - Pain
  - Soft tissue mass
  - Median time to diagnosis 3 – 9 months
  - Constitutional symptoms: fever, weight loss, malaise
  - LAB: LDH increased (marker of advance disease)

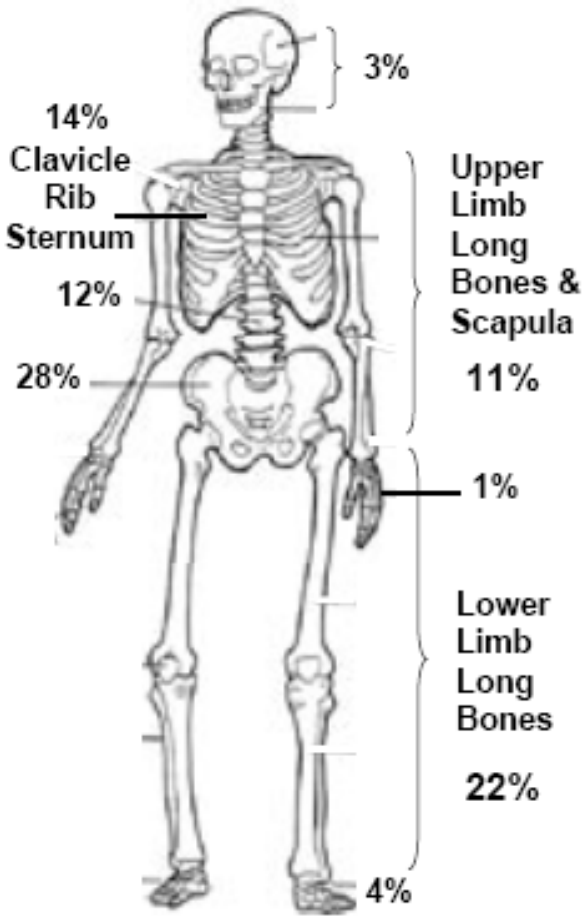


ESFT Site of Origin

- Bone primaries (75%)

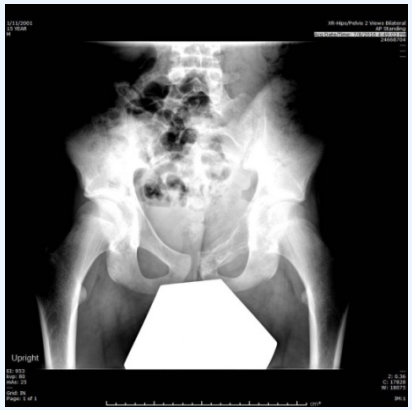
  Axial=extremities

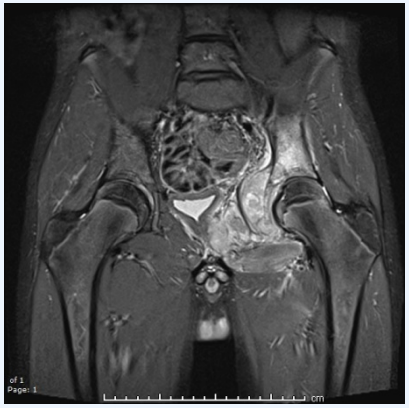
  - Pelvis
  - Long bones
  - Other axial sites
- Soft tissue primaries (25%)
  - Paraspinal
  - Chest wall
  - Various other sites



Mascarenhas et al., 2006
SEER Data 1975-1999

ESFT Investigations





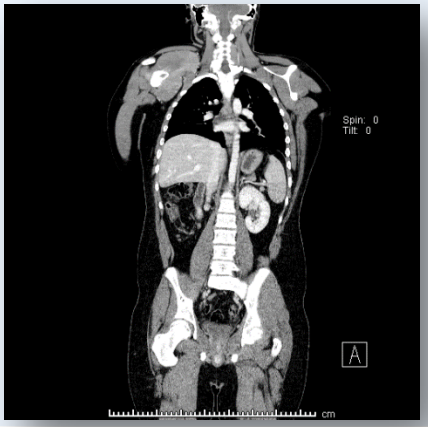
Primary site

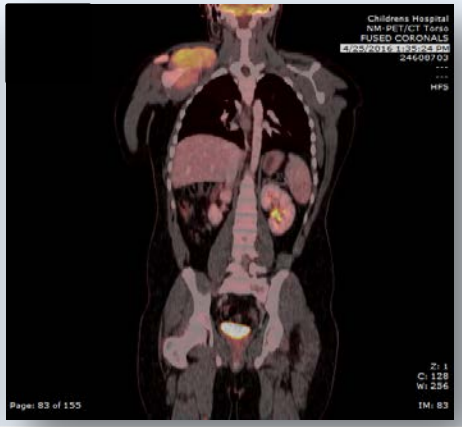
- Plain film
- MRI of affected region

Metastasis detection and staging

- CT chest
- Bone scan
- Bilateral BM biopsy
- PET scan

Tissue biopsy





ESFT Bone Sarcoma Treatment

CHILDREN'S ONCOLOGY GROUP

THAI POG
Thai Pediatric Oncology Group

- **Neoadjuvant**
- **Chemotherapy**

- **Local Control**

Sx **RT** **Sx+RT**

- **Adjuvant**
- **Chemotherapy**

Pediatric Hematology-Oncology
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Thank You

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