Solid tumors

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How does a Solid tumor present?

Latency in presentation.

Asymptomatic/ incidental fining.

Mechanical effect (depends on both mass size and location): pain, bowel obstruction, distention, headache with increased ICP.

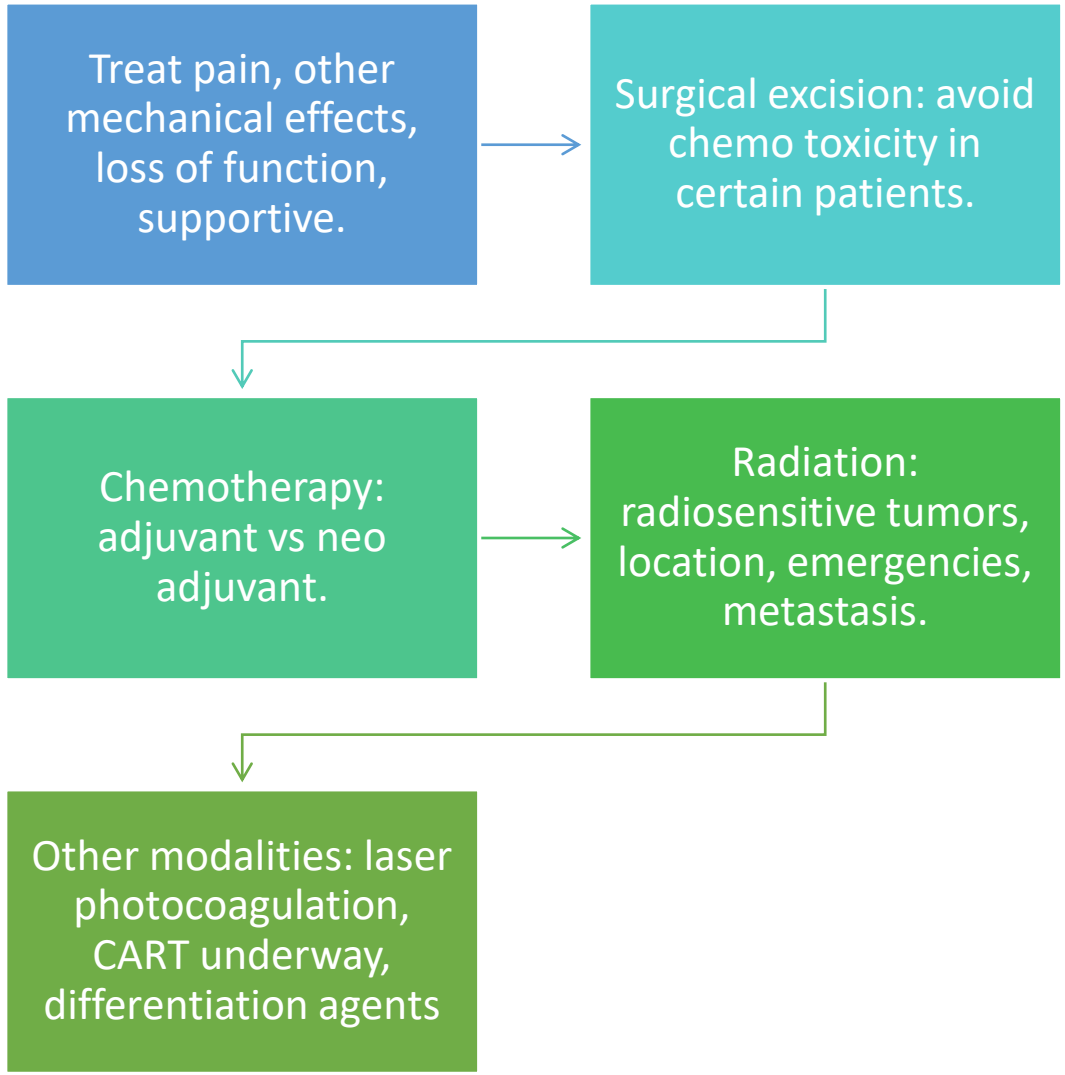
Effect of mediators produced by the mass (as in VIP secreting tumors and pheochromocytoma)

Loss of function (Hypoglycemia in liver tumors. Paralysis in spine tumors).

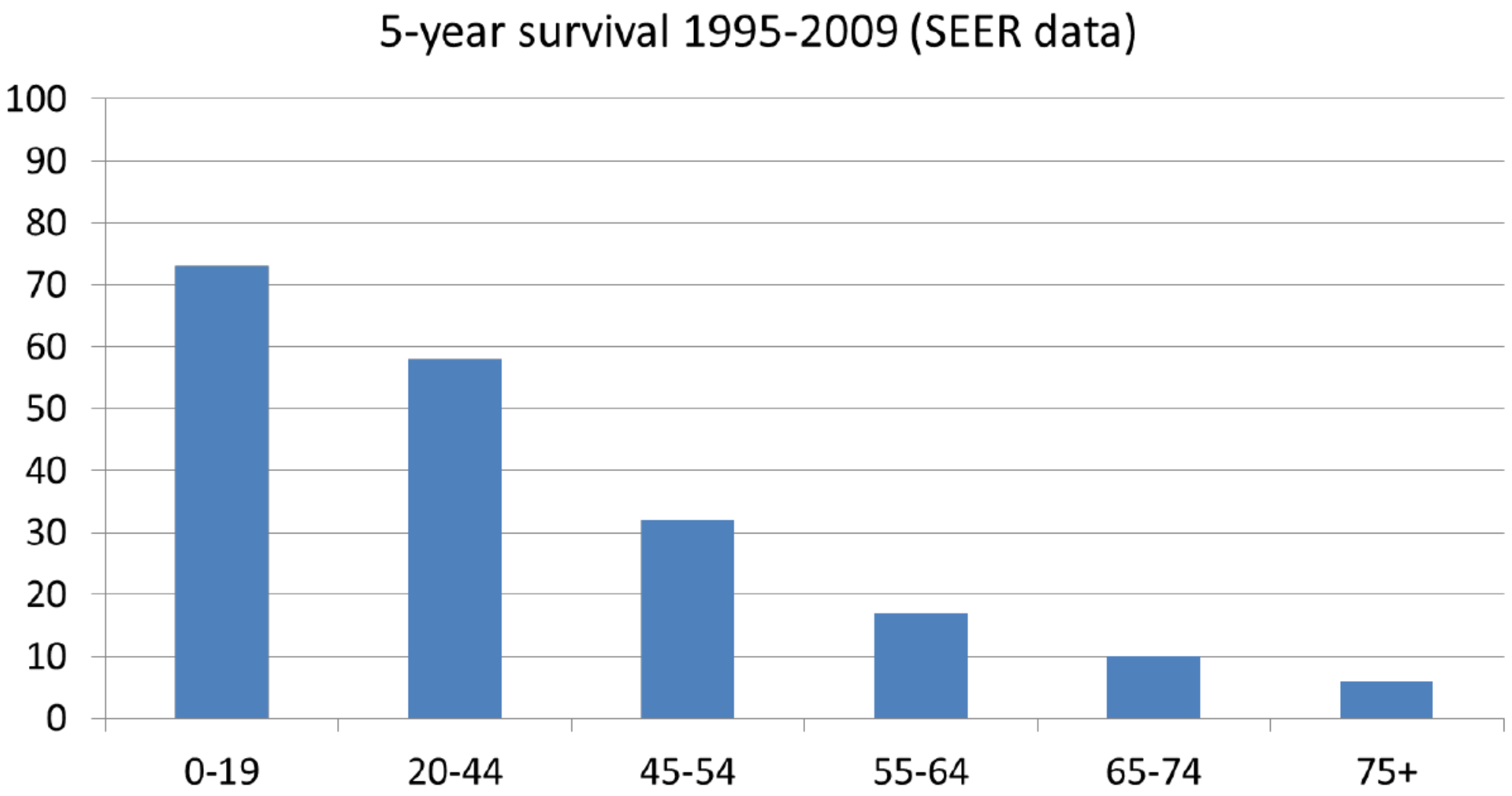
How to work up a solid tumor?

- H&P: family history.
- Baseline labs.
- Genetic evaluation.
- Imaging studies: X ray, US, CT scan, MRI, PET, MIBG.
- Look for mets: chest CT, BMX etc.
- Look for mediators/ hormones etc secreted by tumors.

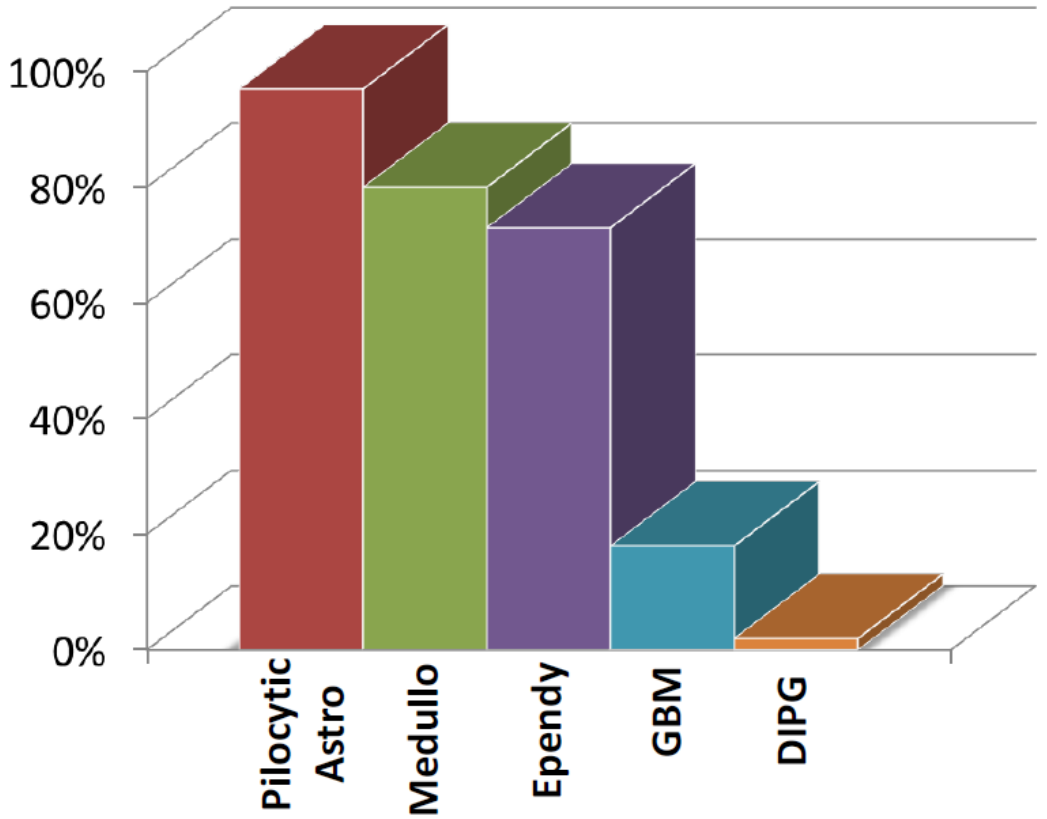
General solid tumor management



Brain tumors


5-year survival 1995-2009 (SEER data)
100
90
80
70
60
50
40
30
20
10
0
0-19
20-44
45-54
55-64
65-74
75+

5-yr Survival Rates



Common presenting symptoms and signs

Nausea, vomiting, headache.

Behavioral and sleep cycle changes.

Weight changes, developmental delay.

Papilledema, bulging fontanels, cranial neuropathies, seizures, imbalance and loss of coordination/ ataxia.

Early preference of one hand before the age of 2 years or change of handedness.

Detailed history and physical exam are very important!

Medulloblastoma

Most brain tumors of childhood are infratentorial

The most common pediatric BT is medulloblastoma

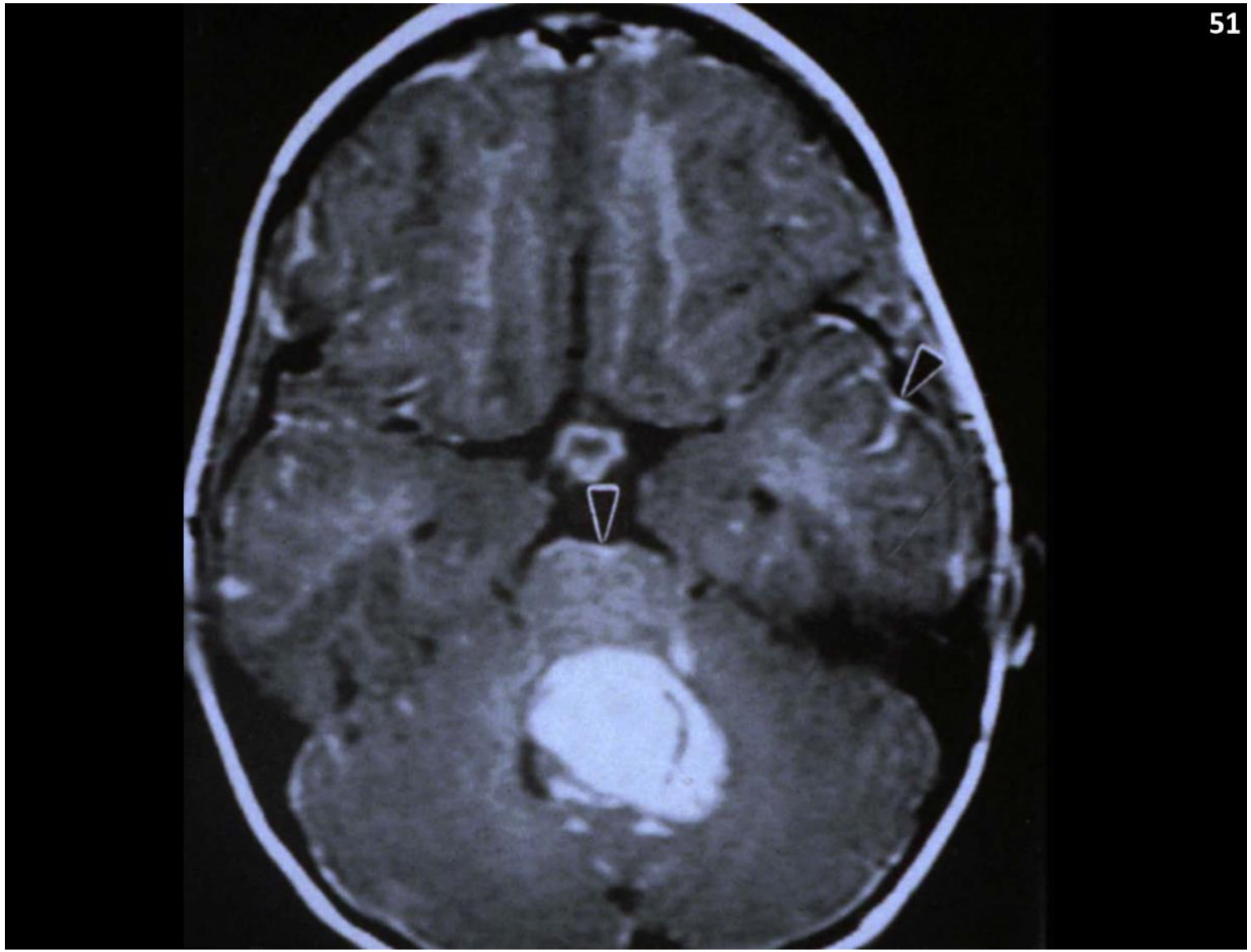
Embryonal origin.

Most are diagnosed under the age of 10 years.

Ataxia, signs of increased intracranial pressure.

Treatment: surgical excision; more complete the excision the better the outcome is, radiation and chemotherapy.

Overall cure rates are very good but long-term growth and neurodevelopmental delays in addition to endocrinopathies are common complications of radiation therapy.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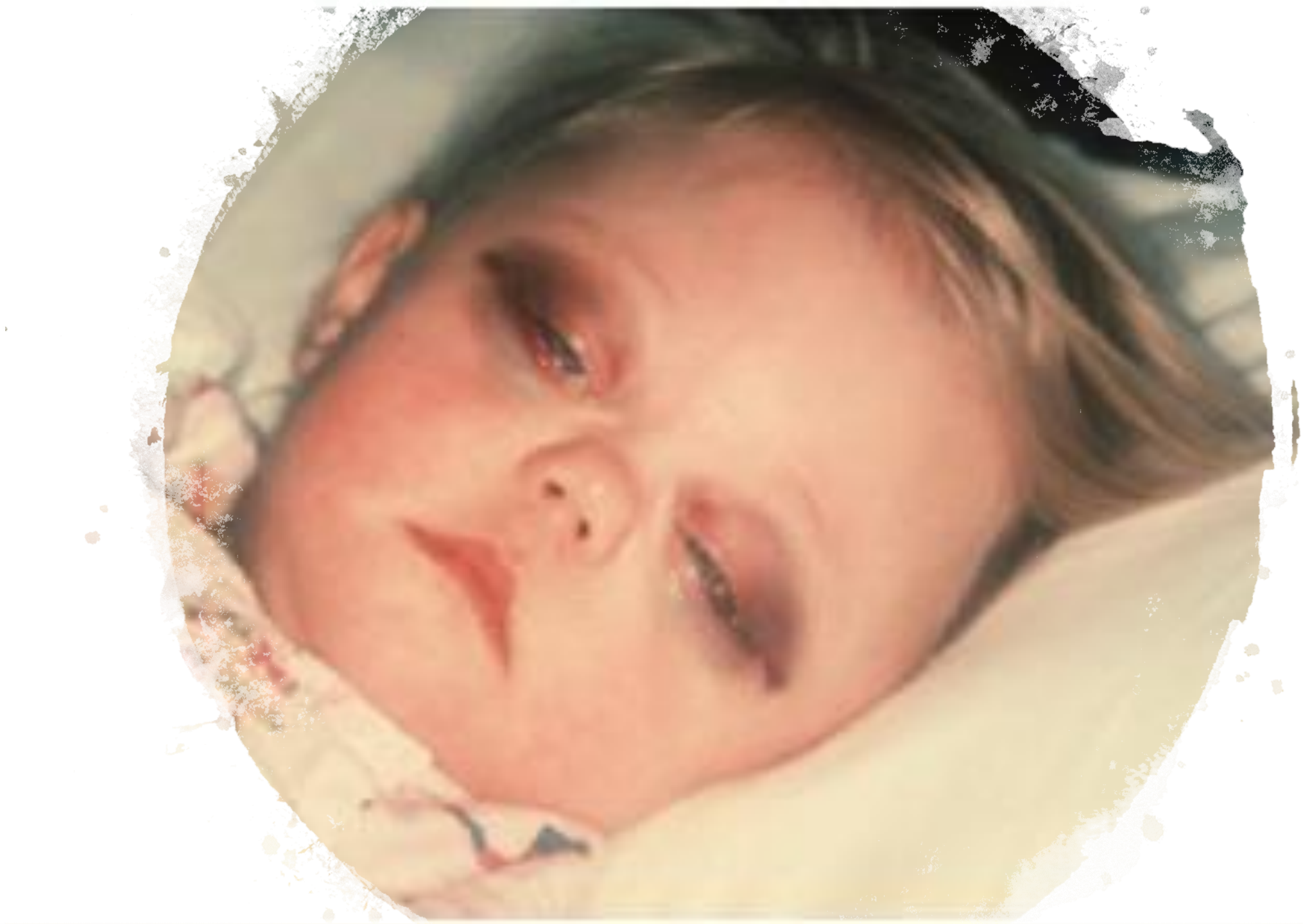
Diffuse intrinsic pontine glioma

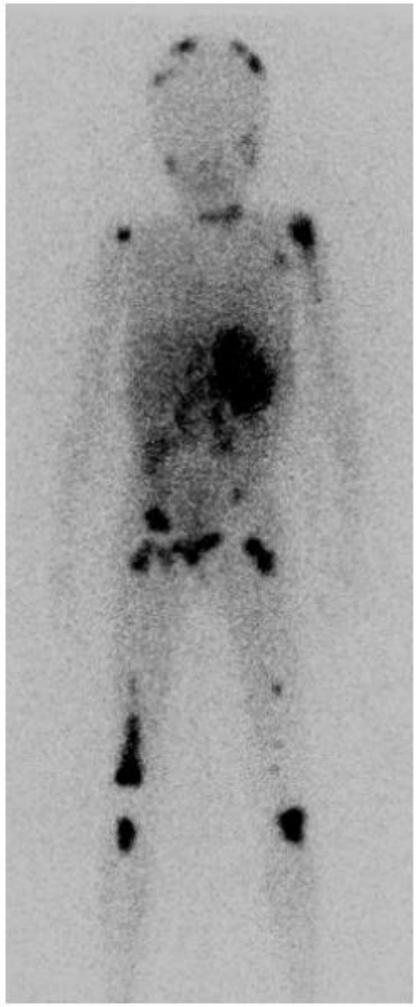
Neuroblastoma

- Third most common childhood malignancy.
- Its an embryonal malignancy, neural crest tissue of the sympathetic nervous system.
- The tumor can arise anywhere along the sympathetic chain, but the classical presentation is an abdominal suprarenal mass.
- Presentation depends on the location of the tumor (neck mass, intrathoracic mass or abdominal mass) and metastasis (skin lesions, anemia due to bone marrow replacement, bony masses and bone pain, proptosis and raccoon eyes).
- It may present with Horner's syndrome if the stellate ganglion is involved.
- Paraneoplastic effects: VIP secreting tumors and opsoclonus myoclonus syndrome were patients present with random eye movements, myoclonus and ataxia (good prognosis but long term neuro complications).

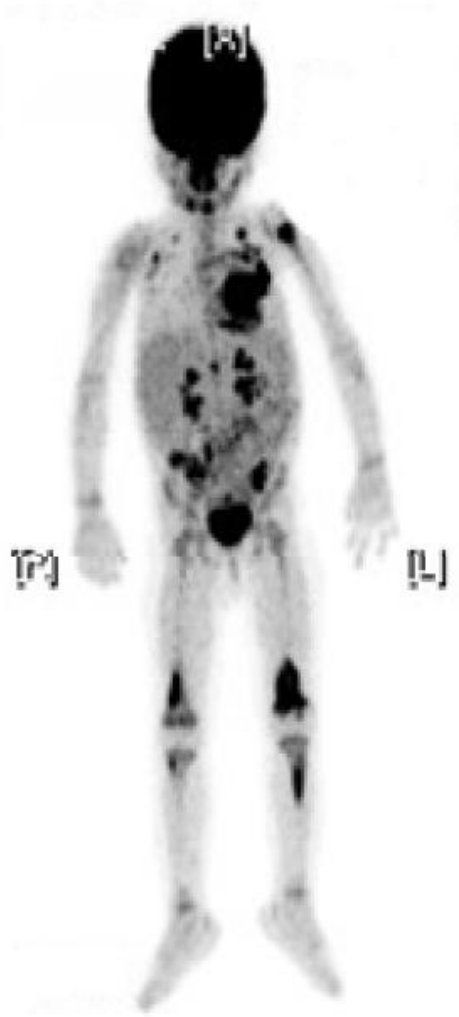
Neuroblastoma

- Poor prognostic features: normal diploid DNA content in tumor cells, advanced stage disease, age above 18 months at presentation, higher risk histologic features (poorly differentiated tumors) , and MYCN oncogene amplification.
- Exception stage 4S in infants (S for skin metastasis) prognosis is excellent.
- Evaluation includes: a chest/ abdomen/ pelvis CT scan, MIBG scan, bone marrow biopsy, spine MRI if involvement of the spine is suspected, urine/ serum testing for catecholamine metabolites (HVA and VMA), counts and chemistries.
- Prognosis was very poor with surgery, chemotherapy and radiation (for select cases). Significant improvement in outcome with addition of autologous stem cell transplant and antibody therapy.





I123-MIBG



FDG-PET

Wilms tumor

- Most common pediatric renal malignancy.
- Most are unilateral, up to 10% can be bilateral.
- It can be associated with some malformations in up to 10% of the cases.
- Aniridia, hemi-hypertrophy, Genito-urinary malformations and others.
- Malformations = earlier diagnosis.
- Patients with over growth syndromes including up to 10% of children with Beckwith- Wiedemann syndrome and some children with Perlman syndrome develop Wilms tumor.
- About 5% of patients with isolated hemi-hypertrophy also develop Wilms tumor.

Wilms tumor

- 2% of all Wilms tumor cases can be familial.
- Genes: WT1(Wilms tumor 1) WT2 and WTX genes.
- Most Wilms have favorable histology with excellent prognosis.
- About 8% have anaplastic histology.
- Presentation: asymptomatic abdominal mass. Occasionally, abdominal pain, hypertension, anemia and hematuria may be present.
- Evaluation: document blood pressure, check for congenital anomalies, evaluation by a geneticist, blood counts, UA, blood electrolytes, liver function testing and chest/ abdominal/ pelvic CT scan or MRI.
- While lower stage disease may be managed with surgical excision alone, higher stage disease require chemotherapy the possibility of radiation for situations like lung metastasis

Osteosarcoma

- Can occur de novo or as a long-term side effect to radiation therapy.
- Patients with hereditary retinoblastoma at high risk for developing osteosarcoma.
- It can be part of Li-Fraumeni syndrome (Tp53 mutation).
- Classical clinical presentation: pain and a mass at the site of the primary tumor.
- Typically involves the metaphysis of long bones.
- Most common sites are the distal femur followed by the proximal tibia followed by proximal humerus.

Osteosarcoma

- Can spread in skip lesions pattern or through hematogenous spread to the lung and other bone locations.
- Diagnostic work up: plain X ray (osteoblastic , osteolytic or a mixture) Classical X ray findings include a Codman triangle caused by elevation of the periosteum and a sunburst pattern due to extension of the tumor through the periosteum. Chest CT scan is done to rule out pulmonary metastasis in addition to a biopsy.
- Treatment relies on surgery and chemotherapy administration. Radiation is not part of treating osteosarcoma.

Ewing sarcoma

- Primitive neuroectodermal tumor.
- Tends to affect the axial skeleton more often than OS.
- Most common location: pelvis. Other locations: femur and ribs.
- Can present with systemic symptoms as fever and weight loss.
- Metastasis can affect the lungs, bone and bone marrow.
- Work up includes bilateral bone marrow biopsies (marrow mets).
- Plain X ray finding described is the onion skin appearance, but Codman triangles and sunburst patterns can be seen too.
- Treatment: surgery, chemotherapy and radiation.

Retinoblastoma

- Rare childhood tumor affecting the retina.
- Most present by the age of 5 years.
- 2 major forms: hereditary, 25% of patients, usually bilateral and multifocal and is due to germline mutations in the RB1. Median age of presentation is around 15 months.
- Non-hereditary form: majority of cases, unilateral or unifocal and is due to mutations in RB1 gene in somatic cells. Median age of presentation is about 30 months.

Retinoblastoma

Most common presenting feature is leukocoria, but strabismus, nystagmus , glaucoma, periorbital cellulitis, proptosis and buphthalmos, can be other features.

Diagnosis: examination under anesthesia of the retina for direct visualization of the tumors and evaluation of intraocular pressure in addition to ocular ultrasound, orbit and brain MRI, bone scan and bone marrow studies (evaluate for metastasis).

Most common metastatic sites: bone, bone marrow, liver and CNS.

Genetic counseling.

Treatment: multidisciplinary care aspects, depends on laterality and potential vision outcome / eye salvage chances.

Retinoblastoma

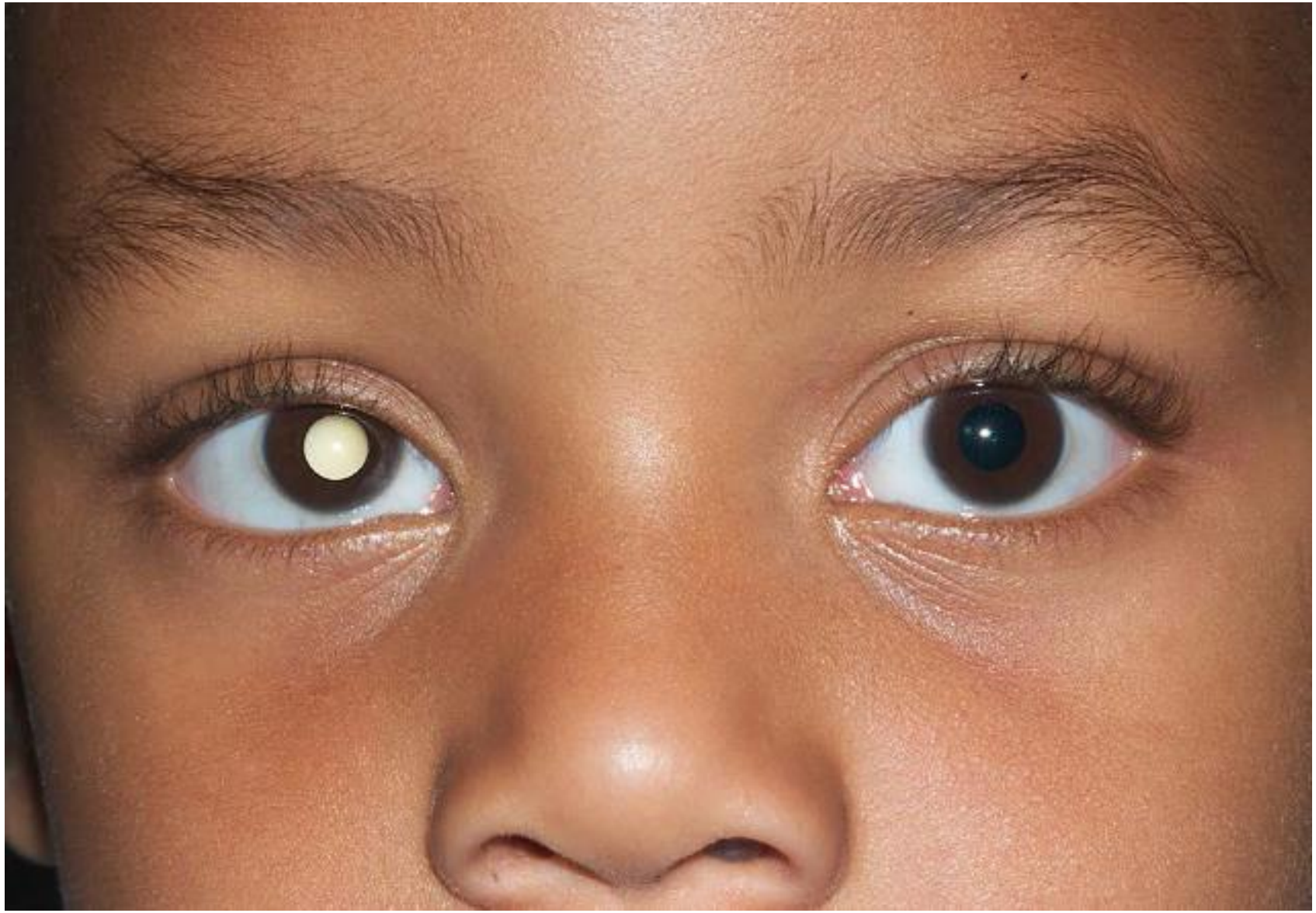
Surgical excision, chemotherapy , radiation and laser photocoagulation are all used modalities for this type of tumor.

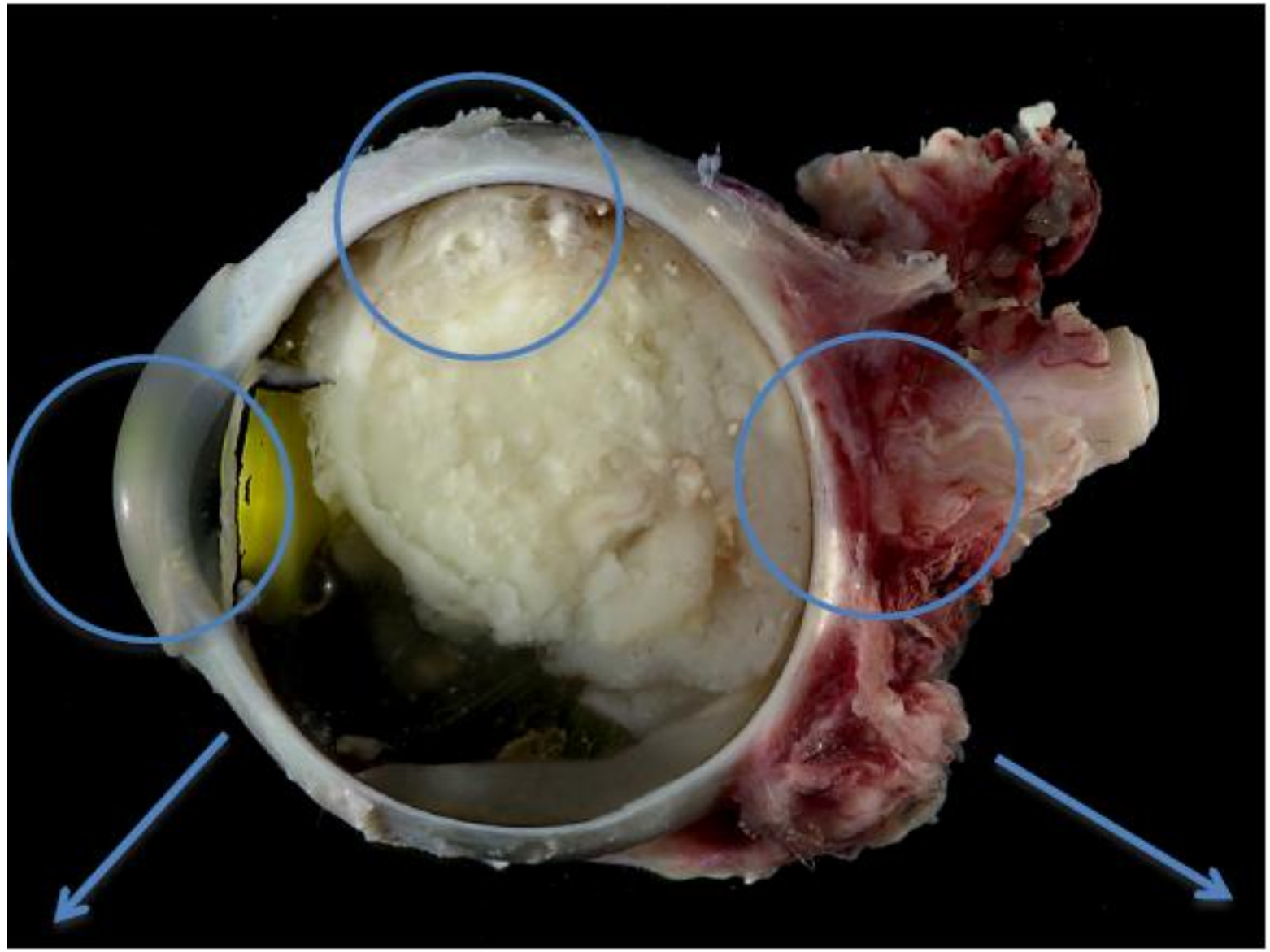
Survivors at high risk for second cancers post therapy.

Most of these second cancers, but not all of them are radiation induced.

The most common second cancer is these patients is osteosarcoma followed by soft tissue sarcomas, melanoma/ other skin cancers, lung cancer and others.

Trilateral retinoblastoma: presence of a midline pineoblastoma in a patient with bilateral retinoblastoma. very poor outcome.





Hepatoblastoma

Most common liver malignancy in children

Typically affects infants and young children with a median age at diagnosis of 19 months

Vast majority of patients less 15 years.

Prematurity and low birth weight are risk factors.

About 5% of hepatoblastoma patients also have familial adenomatous polyposis syndrome showing the importance of obtaining and accurate and complete family history.

Painless abdominal mass (pain present in advanced disease), weight loss, loss of appetite and most cases have elevated alpha feto protein level. If metastasis occurs, its usually to the lungs but other locations are also possible as the brain and peritoneum.

Hepatoblastoma

Workup: biopsy, CT scan imaging (or MRI), abdominal ultrasound and AFP levels.

Normal AFP levels can't rule out hepatoblastoma but are associated with a poorer prognosis and elevated levels can be followed to assess response to treatment.

Treatment is based on a combination of surgical resection and chemotherapy.

Those with unresectable tumors may need a liver transplant to achieve cure.