CHILDHOOD TUMOURS

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Neoplasms of infancy and childhood

- Benign > malignant
- Incidence of malignancy: 1-15 yrs - 1.3 /10,000 /year but leading cause of death after accidents in the West. (developing countries??)
- Most malignant tumours in children arise from hematopoietic, nervous and soft tissues (adults – epithelial)
Benign tumours

- Hemangiomas "port wine stain"
- Lymphangiomas (cystic hygroma)
- Sacrococcygeal teratoma
- Naevi
Sacroccocygeal teratomas

- Germ cell neoplasm
- 1:40,000 live births
- Mass in the sacrum and buttocks
- Composed of elements of > 1 germ cell layer. Mixture of elements.
- < 2 months - benign.
Small, round, blue cell tumours

- Primitive appearance (not anaplastic or pleomorphic)
- Sheets of small, round, blue cells (with dark nuclei, scant cytoplasm, indistinct borders.)
- May show features of organogenesis specific to the tissue of origin.
## Childhood Cancers

<table>
<thead>
<tr>
<th>Cancer</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Leukemia</td>
<td>28%</td>
</tr>
<tr>
<td>CNS tumors</td>
<td>21%</td>
</tr>
<tr>
<td>Lymphomas</td>
<td>11%</td>
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<tr>
<td>Neuroblastoma</td>
<td>7.5%</td>
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<tr>
<td>Wilms’ tumor</td>
<td>6%</td>
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<tr>
<td>Soft tissue sarcoma</td>
<td>6%</td>
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<tr>
<td>OS and Ewing’s sarcoma</td>
<td>5%</td>
</tr>
<tr>
<td>Retinoblastoma</td>
<td>3%</td>
</tr>
<tr>
<td>Others</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

61% of childhood cancers are “solid tumors”

- Abdominal tumors
- Soft tissue tumors
- Bone tumors
- Eye tumors
## Cancer in Children

<table>
<thead>
<tr>
<th>Cancer</th>
<th>Children</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Leukemia</td>
<td>28%</td>
<td>2.3%</td>
</tr>
<tr>
<td>CNS tumors</td>
<td>21%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Lymphomas</td>
<td>11%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>7.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Wilms’ tumor</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>Soft tissue sarcoma</td>
<td>6%</td>
<td>&lt;0.5%</td>
</tr>
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<td>5%</td>
<td>&lt;0.5%</td>
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<td>0%</td>
</tr>
<tr>
<td>Others</td>
<td>12.5%</td>
<td>&gt;90%</td>
</tr>
</tbody>
</table>
Neuroblastoma

- Embryonal malignant tumour
- Neural crest origin
- Neoplastic neuroblasts
- Site: adrenal medulla & sympathetic ganglia
- 7-10% of solid paediatric malignancies.
- Sporadic occurrence.
- Rarely familial (bilateral, multifocal)
Neuroblastoma

- 7-10% of childhood cancers
- 50% diagnosed before 2 yo, 90% by 5 yo
- Arises from neural crest tissue of the sympathetic ganglia or adrenal medulla
- “Small round blue cell” malignancy
Pathology of neuroblastoma

Site: Paravertebral, Posterior mediastinum, abdomen, Adrenal 1/3

Gross appearance:
Nodular, of varying size
May be encapsulated or infiltrative
Cut section: grey-tan, soft and friable, necrosis, hemorrhage, calcifications, cystic change
Gross appearence of Neuroblastoma.
Neuroblastoma

- Post-ganglionic sympathetic neuroblasts
- Often constitutional symptoms: fever, irritability, weight loss
- Other symptoms based on primary site
  - Cervical: neck mass, Horner’s syndrome
  - Thoracic: Superior vena cava syndrome
  - Paraspinal: cord compression
  - Abdominal: fullness, pain, obstruction
  - Metastatic disease: marrow, bone, liver, skin
Microscopy of neuroblastoma

Sheets of small, round, blue cells with dark nuclei, scant cytoplasm, indistinct borders.

Mitosis++, Karyorrhctic debris +

Pleomorphism +/-

Homer-Wright rosettes, Neuropil.

Maturation: Schwann cell, stroma & ganglion cell differentiation
supra renal mass containing fine calcifications, displacing and infiltrating kidney, growing into the renal hilum, crossing midline and displacing vessels
Neuroblastoma

- Elevated VMA, HVA, elevated ferritin, LDH, Abnormal blood counts if marrow involvement

- < 18 mo tend to have low stage, curable disease (70-90% survival)

- > 18 months tend to have metastatic disease (< 15% survival)
The most common symptoms of neuroblastoma are caused by the tumor pressing on nearby tissues as it grows or by cancer spreading to the bone. These and other symptoms may be caused by neuroblastoma. Other conditions may cause the same symptoms. Check with your child’s doctor if you see any of the following problems in your child:

- Lump in the abdomen, neck, or chest.
Less common signs of neuroblastoma include the following:

Fever.
Shortness of breath.
Feeling tired.
Easy bruising or bleeding.
Petechiae (flat, pinpoint spots under the skin caused by bleeding).
High blood pressure.
Severe watery diarrhea.
Jerky muscle movements.
Uncontrolled eye movement.
Swelling of the legs, ankles, feet, or scrotum.
Certain factors affect prognosis (chance of recovery) and treatment options. The prognosis (chance of recovery) and treatment options depend on the following:

- Age of the child when diagnosed.
- Stage of the cancer.
- Where the tumor is in the body.
- Tumor histology (the shape, function, and structure of the tumor cells).
- Whether there is cancer in the lymph nodes.
- Whether there are certain changes in the chromosomes.
- How much time passed between diagnosis and when the cancer recurred.
Treatment options of neuroblastoma may include the following:

**Surgery** alone.

Surgery followed by **chemotherapy**. Sometimes a second surgery is needed.

**Radiation therapy** may be given to treat **tumors** that are causing serious health problems and do not respond quickly to surgery and chemotherapy.

Chemotherapy followed by surgery.
<table>
<thead>
<tr>
<th>Stage</th>
<th>Treatment</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Intact capsule</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Completely excised</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nephrectomy</td>
<td>97%</td>
</tr>
<tr>
<td></td>
<td>Chemotherapy (VCR+DACT)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Tumor beyond kidney</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Completely excised</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nephrectomy</td>
<td>92%</td>
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<tr>
<td></td>
<td>Chemotherapy (VCR+DACT)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Residual Tumor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nephrectomy</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td>Chemotherapy (VCR+DACT+DOX)</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Metastatic</td>
<td></td>
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<tr>
<td></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Lung Radiotherapy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radiotherapy</td>
<td>70%</td>
</tr>
</tbody>
</table>
Wilms’ tumour (Nephroblastoma)

- Malignant neoplasm of embryonal nephrogenic elements (MUTATION OF GENE WT1 ON CHROMOSOME 11 AND NEPHROBLASTEMATOSIS- persistant of blastema in kidney tissue)

- Composed of embryonal elements

- Prevalence: 1:10,000

- 2-5 yrs

- Good prognosis

- Associated with congenital malformations

- Tumour resembles developing kidney
Associated syndromes

- WAGR – Wilms tumour, Aniridia, Genitourinary anomalies, mental Retardation
  - WT 1 gene

- Denys-Drash syndrome: Wilms tumour, intersexual disorders, glomerulopathy. WT1 gene

- Beckwith – Wiedemann syndrome (BWS) : Wilms tumour, overgrowth, visceromegaly, macroglossia. WT2
Beckwith-Wiedemann Syndrome

- Congenital disorder of growth regulation
- 1/14,000 children
- Macrosomia, macroglossia, neonatal hypoglycemia, abdominal wall defects, ear anomalies, visceromegaly
- May be associated with hemi-hypertrophy
- 4-21% of patients develop cancer
- Wilms tumor (43%) and Hepatoblastoma (12%)
- Q4 month abdominal u/s until age 8
Cut surface : bulging, pale tan
Histopathology of Wilms tumour

- It is malignant mixed tumour containing metanephric blastema, stromal and epithelial derivatives. Can be classified into:
  - A) Favourable (does not have anaplastic cells)
  - B) UnFavourable (anaplastic)
Clinical features

- 1-3 yrs
- Unilaterial (sporadic), bilateral (familial)
- Large abdominal mass
- Hematuria
- Pain abdomen
- Hypertension
- Intestinal obstruction
- Pulmonary metastasis
The most common symptom is a swollen abdomen, which is usually painless. Sometimes a parent or carer may feel a lump in the abdomen which can be quite large. Occasionally, the tumour may bleed slightly and this can irritate the kidney and may be painful.
There may be blood in child's urine, or their blood pressure may be raised. The child may also have a high temperature (fever), upset stomach, weight loss or a lack of appetite.
Wilms Tumor

- Imaging: CT scan or ultrasound
  - Must evaluate contralateral kidney
  - Can metastasize to liver and lungs

- Staging and histology of tumor important for prognosis
  - Overall survival rate of 90% (Stage IV, unfavorable histology has 17% overall survival rate)
CT Scan of Abdomen
Stage 1

- The tumour is only affecting the kidney and has not begun to spread. It can be completely removed with surgery.

Stage 2

- The tumour has begun to spread beyond the kidney to nearby structures, but it’s still possible to remove it completely with surgery.
Stage 3

The tumour has spread beyond the kidney; either because the tumour has burst before (or during) the operation, has spread to lymph glands (nodes), or has not been completely removed by surgery.
Stage 4

The tumour has spread to other parts of the body such as the lungs or liver. Tumours in other parts of the body are known as metastases.

Stage 5

There are tumours in both kidneys (bilateral Wilms' tumour).

If the tumour comes back after initial treatment, this is known as
Treatment for Wilms tumor is based mainly on the stage of the cancer and whether its histology (appearance under the microscope) is favorable or unfavorable. In the United States, doctors prefer to use surgery as the first treatment in most cases, and then give chemotherapy (and possibly radiation therapy).