Pelvic tumor in childhood
Classification, imaging approach and radiological findings

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Solid pelvic masses in childhood composed from a group of rare and heterogeneous tumors originating from different pelvic organs or structure.

Principally the pelvic mass should be categorized in three groups:

I. Rhabdomyosarcoma

II. Germ cell tumors

III. Other rare and incidental tumors localized in the pelvic region, also to be found anywhere in the body with different origin and histology
• Following earlier report the pelvic tumors are strongly related to the compartmental location.
• Anterior midline mostly is the location for rhabdomyosarcoma (RMS).
• Middle midline is the location for a germ cell tumor as well as a RMS.
• Posterior midline frequently is the origin of a neurogenic or a germ cell tumor.
• Lateral pelvic region other soft tissue and bone tumors.
Patient material

The patient material includes 90 cases of pelvic and testicular tumors in male and female. The anatomic location, the value and limitation of performed different imaging procedures were retrospectively analyzed.
I. Rhabdomyosarcoma (RMS)

- Tumor will arise from primitive cell in any organ.
- Represents 5% - 10% of malignant solid tumor in childhood.
- Ranking 4th in frequency after:
  - CNS
  - Neuroblastoma
  - Wilms tumor
- Bimodal presentation, primary peak 2-5 years of age, secondary 12-16 years of age.
- Site classification following intergroup RMS study:
  - Head and Neck (35 %)
  - Genitortinary system (26 %)
  - Extremities (19 %)
  - Other bodyparts (20 %)
Patient material of rhabdomyosarcoma

There are 18 reviewed cases, 13 boys and 5 girls with the following localisation.

<table>
<thead>
<tr>
<th>Localisation</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>2</td>
</tr>
<tr>
<td>Bladder</td>
<td>4</td>
</tr>
<tr>
<td>Vagina</td>
<td>3</td>
</tr>
<tr>
<td>Paratesticular</td>
<td>5</td>
</tr>
<tr>
<td>Originated from urachus</td>
<td>4</td>
</tr>
</tbody>
</table>
Imaging approaches of RMS

• Conventional as excretory urogram and micturation cystourethrogram as well as angiography in 4 cases (from more than 20 years ago).
• Later ultrasound routinly used as first diagnostic procedure.
• Use of CT or MRI or both in all remaining cases.
RMS of the prostate grows rapidly and extend outside the capsule invading the bladder and posterior urethra. This tumor mostly is histologically botroid of type.
15-year-old boy with a prostatic rhabdomyosarcoma invading the bladder
RMS of the vagina

Most RMS of the vagina arise in the anterior wall of the vagina adjacent to the cervix.
Paratesticular RMS

The RMS of the testis are histological embryonic of aspect with intermediate prognosis originated of spermatic cord. The patients are less than 5 years of age.
RMS of the bladder and urachus

RMS typically involves the submucosal region of the trigon, histologically botroid with a good prognosis. RMS in the dome of the bladder is mostly urachal of origin.
II. Germ cell tumors in children

Germ cell tumors in children are rare entities contributing more than 3% of all pediatric cancer, frequently they encountered in the gonads, but they also are located incidentally in other regions such as in pineal gland, retroperitoneum as well as the sacral area.

Histological classification of the germ cell tumors is complex, principally they can be categorized as shown in following table.
## Patient material germ cell tumor (60)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature and immature</td>
<td>15</td>
<td>Mature teratoma of the</td>
</tr>
<tr>
<td>ovarian teratoma</td>
<td></td>
<td>testis</td>
</tr>
<tr>
<td>Sacrococcygeal</td>
<td>33</td>
<td>Sacrococcygeal teratoma</td>
</tr>
<tr>
<td>teratoma</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yolk Sac tumor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(testicular)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non seminoma</td>
</tr>
</tbody>
</table>
Ovarian teratoma

- Cystic teratoma is by far the most common tumor, accounting for more than 90% benign ovarian neoplasms. On the basis histological examination teratomas are classified as mature (90%), immature (containing embryonic neural elements) and malignant.
- The sonographic appearance of teratomas is variable depending on relative amount of sebum, serous fluid, calcium, hair and fat.
- The tissue characteristic, location and extension of teratomas could be easily demonstrated by MRI and CT.
Ovarian teratoma (histologically mature)
Ovarian teratoma
(histologically immature with dissemination of glia tissue)
Primary testicular germ cell tumor

- Teratoma is the principal benign germ cell tumor of the testis.
- Affected boys are usually younger than 4 years of age (85%).
- Teratomas on later life tend to be more aggressive and malignant.
- Yolk Sac carcinoma, teratocarcinoma and choriocarcinomas are all the malignant type of the testicular germ cell tumor.
Mature teratoma of the right testis.
Sacroccocygeal teratoma

- Sacrococcygeal teratoma represents about 40% of the germ cell tumors.
- Females are more affected than males (4:1).
- The frequency of malignancy depends on age:
  
  - 7% (girls) and 10% (boys) in infants younger than 2 months of age.
  
  - 47% (girls) and 66% (boys) on later life.
Sacrococcygeal teratoma

• Imaging appearance of the tumor is variable depending on the relative amounts of soft tissue and cystic components.
• Sonography can provide useful information regarding the internal characteristics of the sacrococcygeal teratomas.
• MRI is the first modality of choice to determine the total extent of the mass.
Newborn baby with a large sacrococcygeal teratoma type I
Malignant pelvic Yolk Sac tumor
III. Miscellaneous

- Pelvic masses categorized in this group have no relation to RMS or germ cell tumors, neither histologically nor pathogenetically.
- Some of them however originate from the genital system (4 cases).
- They could be osteogenic or related to pelvic soft tissue (5 cases).
- Neurogenic and lymphatic neoplasms are a subgroup under this category of pelvic masses (3 cases).
A boy with neurofibromatosis with a neurofibroma of the prostate gland.
Pelvic Ewing sarcoma right-sided.

Note the huge soft tissue

Pelvic osteosarcoma right-sided.

Note the massive destruction of the ileum.
Malignant fibrohistiocytoma
Primary malignant pelvic lymphoma
Conclusions

- Dividing the pelvic space into three midline compartments (anterior, middle and posterior) as well as lateral and pelvic floor is useful to define the tumor type.
- Rhabdomyosarcoma of the lower urogenital system is more frequent in male patients (ratio 2:1) and originates from epididymis, prostate bladder and urachus.
- Sacrococcygeal teratoma is the most common germ cell tumor in girls with an increasing malignancy of ± 10 % in neonates and up to 66 % in later life.
Conclusions

• Sonography should be considered a sufficient modality in recognition of scrotal mass. Additional contribution of other modalities is not relevant.

• Sonography is a sufficient imaging modality in neonatal sacrococcygeal teratoma type I and cystic abdominal teratoma on later life if little or no soft tissue is detected.

• Sonography is only an initial procedure for evaluation of pelvic malignancy, MRI more than CT is required for recognition of tumoral extension and extrapelvic metastasis.

• CT and MRI are imaging modalities of choice in diagnosis of all masses located around close to the urogenital system osteogenic, or non-osteogenic.