Imaging of primary liver tumors in childhood
An overview and report of 20 cases

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Introduction

- 15% of all abdominal tumors in childhood are primary liver neoplasms.
- Liver tumors comprise a mixed group of masses with different anatomic and histological changes.
- Two third of all liver masses are malignant.
- The ultimate diagnosis is based on clinical, radiological and pathological information.
## Incidence of hepatic tumors in children

<table>
<thead>
<tr>
<th>Tumor</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatoblastoma</td>
<td>Most frequent</td>
</tr>
<tr>
<td>Hepatocellular carcinoma</td>
<td>Less frequent</td>
</tr>
<tr>
<td>Benign vascular tumor</td>
<td>Less frequent</td>
</tr>
<tr>
<td>Mesenchymal hamartoma</td>
<td>Rare</td>
</tr>
<tr>
<td>Malignant mesenchymoma</td>
<td>Rare</td>
</tr>
<tr>
<td>Adenoma</td>
<td>Rare</td>
</tr>
<tr>
<td>Focal nodular hyperplasia</td>
<td>Rare</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>Rare</td>
</tr>
<tr>
<td>Inflammatory pseudotumor</td>
<td>Rare</td>
</tr>
<tr>
<td>Rhabdomyosarcoma</td>
<td>Rare</td>
</tr>
<tr>
<td>Livercysts</td>
<td>Rare</td>
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</tbody>
</table>
Clinical presentation

- Most common sign is an abdominal mass in the right upper quadrant (65% to 90%).
- Local pain or discomfort.
- Jaundice is more common in hepatocellular carcinoma.
- Vomiting, weight loss, irritability, anorexia and fatigue are frequent findings.
- Hepatocellular carcinoma and hepatoblastoma cannot be differentiated on base of clinical symptoms.
- Alpha-fetoprotein is a useful marker for hepatomas.
The aim of imaging studies of liver masses

- Solid or cystic
- Vascularity and enhancement pattern
- Size, mono- or multifocal
- Segmental localization
- Invasion of portal vein, hepatic veins or inferior caval vein
- Relation to portal and hepatic veins
- Metastasis
Patient material

- This presentation includes the clinical and morphological findings of 20 children suffering from a malignant hepatoma following a retrospective study.

- The patient material comprised from 15 infants and children with a histological proven hepatoblastoma and 5 children with a hepatocellular carcinoma.

- Additionally 6 cases with benign liver masses were analyzed for comparison to malignant hepatic tumor.
Clinical findings

- Palpable mass in right upper quadrant: mostly
- Abdominal pain: frequently
- Vomiting: incidentally
- Elevated serum alpha-fetoprotein in nearly all cases
Preexisting diseases in 20 cases of hepatoma

<table>
<thead>
<tr>
<th>Hepatoblastomas (15)</th>
<th>Mother with polyposis coli (1)</th>
<th>Beckwith-Wiedemann syndrome (1)</th>
<th>Subarachnoidal cyst (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatocellular carcinoma (5)</td>
<td>Congenital hydrocephalus with ventriculoperitoneal drain (1)</td>
<td>Tyrosinemia type I (1)</td>
<td></td>
</tr>
</tbody>
</table>
# Age and sex distribution

<table>
<thead>
<tr>
<th>Tumor</th>
<th>Age</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatoblastoma (15 cases)</td>
<td>6-24 months (13 cases)</td>
<td>10 male 5 female</td>
</tr>
<tr>
<td></td>
<td>Remaining 2 cases: 6 and 9 years</td>
<td></td>
</tr>
<tr>
<td>Hepatocellular carcinoma (5 cases)</td>
<td>2, 5, 6 and 10 years 3-week-old neonate with tyrosinemia type I</td>
<td>2 male 3 female</td>
</tr>
</tbody>
</table>
Tumor localization

Hepatoblastoma
- Right lobe: 10
- Left lobe: 3
- Multifocal: 2

Hepatocellular carcinoma
- Large mass central: 3
- Large mass left-sided: 1
- Large mass right-sided: 1
Therapeutical approach

Chemotherapy pre- and postoperatively: 16
Hemihepatectomie: 11
Liver transplantation: 4
<table>
<thead>
<tr>
<th>Imaging studies</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasound</td>
<td>20 cases</td>
</tr>
<tr>
<td>CT only</td>
<td>9 cases</td>
</tr>
<tr>
<td>MRI only</td>
<td>4 cases</td>
</tr>
<tr>
<td>CT + MRI</td>
<td>4 cases</td>
</tr>
<tr>
<td>Angiography</td>
<td>2 cases</td>
</tr>
</tbody>
</table>
Findings on ultrasound in hepatoma (n=20)

- Mixed pattern of predominantly increased echogenicity nearly in all cases.
- Hypoechoic areas due to hemorrhage or necroses in 3 cases.
- Sonographic signs of calcification in 4 cases.
- Poorly defined margins in most cases.
- Color Doppler studies with marked increased vascularity in 2 cases.
6 months old girl with a subarachnoïdale cyst, treated with ventriculoperitoneal drainage.

Hepotablastoma in the age of 6 months.

The hepatic tumor is resected.
Ultrasound of a 3,5-year-old boy with a hepatoblastoma. The tumor is resected after chemotherapy. Mother treated for polyposis coli.
CT and ultrasound of a hepatoblastoma in a 6-month-old boy.

Later lung metastases were resected.

7 years follow-up.
CT findings

- The tumors are mostly hypodens, inhomogeneous and partly lobulated.
- Mixed enhancement of neoplastic tissue after contrast injection.
- Low density areas due to hemorrhage and necrosis in few cases.
- CT angiography visualized the vascularisation of the tumor and invasion of large vessels (n=1).
- Calcification of the tumor and its localization were seen in 4 cases.
- Resectability of the tumor was clearly analyzed in 11 cases. Irresectability in 4 cases led to liver transplantation.
- In 7 cases lung metastases were found on chest CT.
CT in a 2-year-old boy with hepatoblastoma.

Lung metastases.

Treated with hepatectomy and chemotherapy.

Follow-up until 12 years of age.
Ultrasound and CT in a 6-month-old girl with a multifocal hepatoblastoma.
Treated with liver transplantation.
Follow-up: 6 years.
MRI findings

- Low mixed signal intensity of tumor tissue on T1 in nearly all cases.
- No clear differences of intensity between hepatoblastoma and hepatocellular carcinoma.
- Marked enhancement of central area of lesion after contrast injection in most cases.
- Visualization of vascularity of tumor and big vessels is similar to CT. The invasion of vessel and the resectability of tumor can be predicted accurately.
MRI and US in a 1-year-old girl with a hepatoblastoma segment 5, 6 and 8 with calcifications.

The tumor was resected.

Up to the age of 7 years no recurrences reported.
CT and MRI of a 2-year-old boy with a multifocal hepatoblastoma.

Infiltration in inferior caval vein.
Lung metastases.

Complete remission up to the age of 8 years
CT and MRI of a 5-year-old boy with hepatocellular carcinoma.

Note: central position of the large tumor.

Chemotherapy and liver transplantation.

Follow-up up to the age of 6-years.
Benign hepatic masses
(Differential diagnosis)

Hemangioendothelioma : 3
Mesenchymal hamartoma : 1
Adenoma : 1 (adult)
Livercyst : 1
CT and US in a young woman with liveradenoma after longterm use of oral anticonceptiva.

The adenoma disappeared after stop of oral anticonceptiva.
MRI in a 4-month-old Iranian boy with hemangio-endothelioma in liver.
US and angiogram of a 2.5 year old girl with a mesenchymal hamartoma without cystic changes.
Conclusions

- Ultrasound is the first step in the diagnosis of liver masses.
- Ultrasound is helpful in identifying hepatic malignancy and vascularity of tumors.
- CT is the most appropriate modality in predicting resectability of hepatomas.
- Chest CT should be performed routinely to exclude lung metastasis.
- MRI has identical accuracy as multislice CT for the resectability of hepatic tumors.
- The accuracy of MRI or CT depends strongly on experience and equipment facilities.
- In case of suspected malignancy of hepatic tumors diagnosis must be confirmed by biopsy.