LIVER NODULAR LESIONS IN THE CHILDREN – BASIC IMAGISTIC APPROACH

SB Motoi[1], Simona Cerbu[2], F Birsasteanu[1]

Abstract

For the diagnostic of the nodular hepatic diseases the methods are including: ultrasound, computed tomography, magnetic resonance imaging and angiography.

Ultrasound can identify the structure cystic or solid nature, and also the calcification from the tumor.

Computed tomography is helpful in examining children because the time of investigation is short and it is giving the segmental anatomy.

Magnetic resonance imaging is "the gold standard" for the pathology of the liver; it has a good contrast of soft tissue and has no ionizing radiation. Magnetic resonance imaging using organ–specific contrast agents can appreciate the type of the cellularity from the tumor and in children is preferred over invasive procedures.

These two imaging modalities are preferred technique because it is important to establish the segmental anatomy and the vascular structures for the resecability of the lesion.

Key words: liver nodules, benign, malign, magnetic resonance imaging

Introduction

Two-thirds of the liver tumors in children are malignant. The prevalence of the benign hepatic tumors in children is much lower than in adults [1]. We appreciate that MRI investigation is the better modality for evaluation of the focal liver lesions.

The aim for scanning times is 20 to 35 minutes for abdomen and pelvis in pediatric population. Based on their level of cooperativeness the children are classified into three age groups: infants (under 1,5 years), small children (1-6 years) and older children (6-18 years); the MRI examination is specific for each group op children [2]

Imaging of infants is better at 3,0 T than 1,5 T. It is important to use fat suppression to improve image quality and soft tissue contrast resolution [3]

Small children are more alert and more anxious so they will require small sedation.

Older children have ability to cooperate with hold breath instruction.

Classification of the liver neoplasm in relation to age: [4]

Under five years of age	Over five years of age
Hepatoblastoma	Hepatocellular carcinoma
Infantile hemangioendothelioma	Undifferentiated embryonal sarcoma
Mesenchymal hamartoma	Fibrolamellar carcinoma
Metastases from neuroblastoma, Willm's tumor	Metastases
Angiosarcoma	Adenoma

Infantil hemangioendothelioma

It represents the most common benign liver tumor in children [5]

It is discovered within the first six months of life, males are less affected than females.

The tumor may be presented as solitary or multiples nodules affected both lobe and may have sharp or ill-defined margins. The multinodular type involve the skin and also other organs [6]

The lesion is typically heterogeneous low signal T1-weighted images with intralesional hemorrhages, high signal on T2-weighted images. After contrast administration (gadolinium) the lesion show peripheral enhancement in early arterial phase and also persistent central enhancement in late phase. In interstitial phase the nodules enhance homogeneously – fig 1. [7,8]

[1]University of Medicine and Pharmacy "Victor Babeş" Timişoara, România
[2]Emergency Children's Hospital "Louis Ţurcanu" Timişoara, România
E-mail: sorin.motoi@o2it.ro, cerbusimona@yahoo.com, fbirsasteanu@yahoo.com

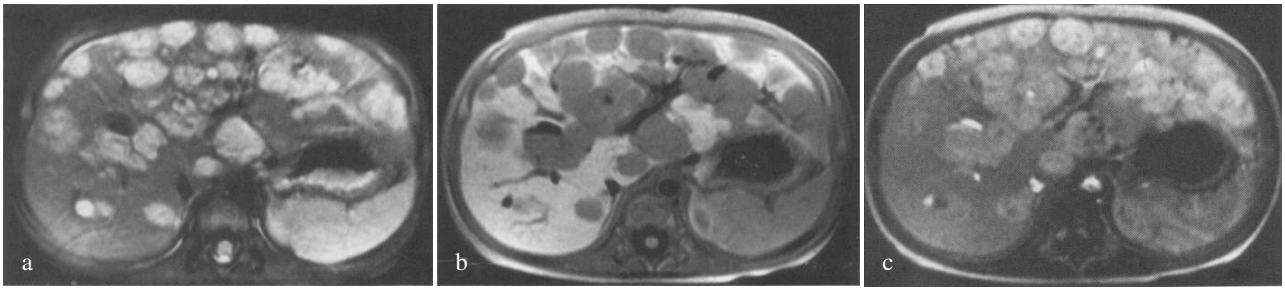

Fig. 1 - Infantile hemagioendothelioma - 18 month old boy: a) T2-weighted fat-suppressed shows multiple nodular lesions, small size, under 1cm, appear in hight signal intensity; b) the lesion in T1- weighted before contrast; c) T1-weighted fat-suppressed on the interstitial-phase, after homogeneously gadolinium enhanced.

Hepatoblastoma

Is the most common hepatic tumor in children; can appear from the newborn to adolescent prior but rarely older.

The tumor is detected by 3 years old, and boys are more affected than girls 3:2.

The tumor is solid and may present calcifications and necrosis, multiple septa and fibrous bands; it is well defined by a pseudocapsule [9]

The tumor can be seen in older children, over 5 years, and the clinical and imagistics aspects mimic HCC, with vascular invasion and recurrence, and the prognostic is worse.

Sometimes the hepatoblastom is multifocal, involved the organs: lung, kidney, brain and abdominal lymph nodes [10]

In 50% of children the hepatoblastoma is an incidental finding, only 25% presents abdominal pain, fever, weight loss; only 10% presents fewer with jaundice [11]

AFP is positive also in hepatoblastoma and in HCC, but has higher values than in adult with HCC [12]

In hepatoblastoma can observe high values of human chorionic gonadotropin associated with early puberty. Thrombocytosis can appear in 93% [9]

CT has a fundamental role to determinate the extension of the tumor but also the metastases from lung and lymph nodes [9]

After contrast administration, we observe early enhancement, heterogeneously, hyperintense in the fibrotic areas and with rapid wash out in the portal phase; in the delayed interstitial phase after gadolinium, the lesion became heterogeneously hypo- or isointense [11] – fig 2. [13]

Differential diagnosis on CT and MRI imaging can be done with: hemangioendothelioma, neuroblastoma metastasis, mesenchymal hamartoma, hapatocellular carcinoma.

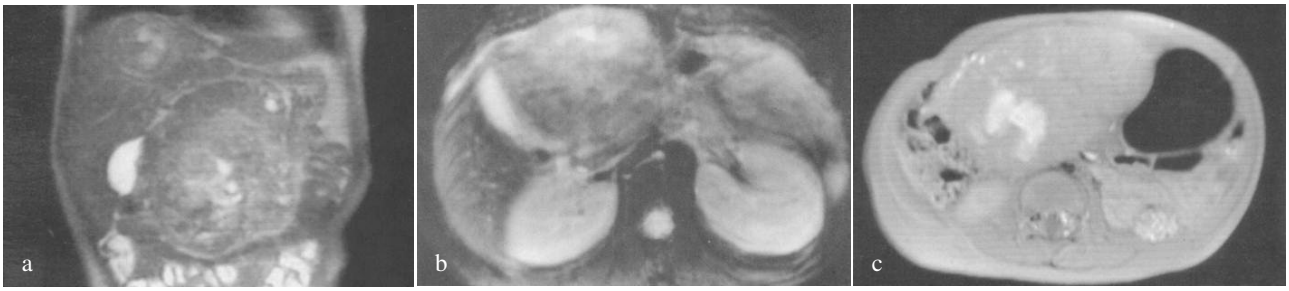

Fig. 2 - Hepatoblastoma - 1 year old boy: a) coronal T2-weighted image which demonstrates a large hepatic mass, with heterogeneous signal; b) transverse T2-weighted fat-suppressed image show a high signal in the center of the mass consistent with hemorrhage; c) T1-weighted immediate postgadolinium show diffuse enhancement.

Mesenchymal hamartoma

It is a benign developmental cystic liver tumor; appears under 2 years old, males are more affected than females. Sometimes these abnormalities develop before birth. It can be a prenatal diagnosis on ultrasound and in MRI imaging [14]

Ultrasonographic features show multiple cysts with internal septations, well defined, with variable sized from few mm to cm. The cystic mass measuring 15 cm, is well defined, has no calcifications and after contrast administration on CT or MRI, septa and solid components enhance – fig 3. [15]

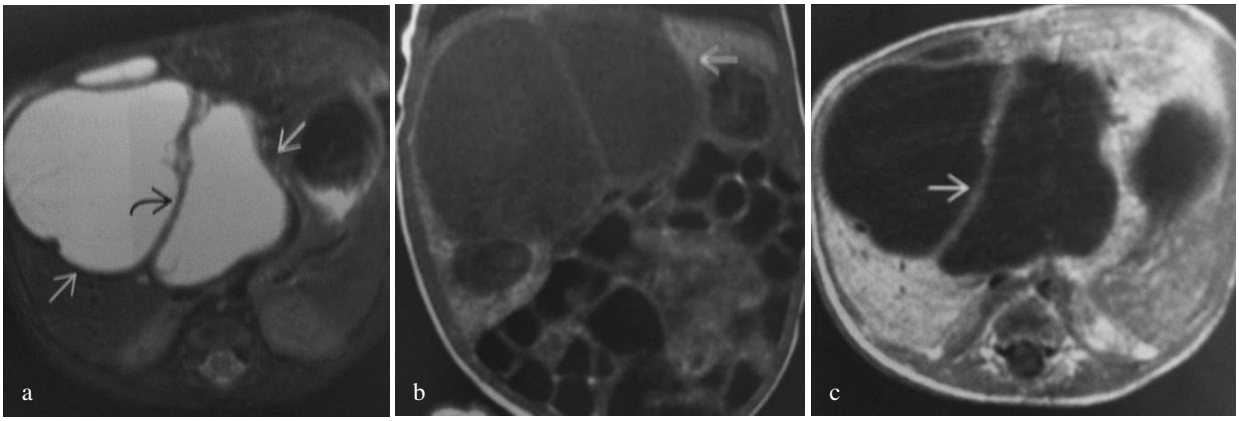

Fig. 3 - Mesenchymal hamartoma – 2 weeks old boy, diagnosticated on a prenatal ultrasound: a) on axial T2-weighted image shows a multicystic septated mass; b) the hepatic mass in a coronal T1-weighted image before contrast; c) axial T1 weighted-image after gadolinium enhance show the enhance of the thickened septation.

Hepatocellular carcinoma

After hepatoblastoma, HCC represent the second most common malignant tumor of infancy. It has two peak periods, between four and five years and between 12 and 14 years of age [16]

It is well documented in childhood; most cases are associated with metabolic disease (tyrosinemia) and infection with HVB [17]

Macroscopically there are three different growth pattern of HCC [9,18, 19]

Type one is a massive solitary non-encapsulated mass;

Type two multifocal can simulate metastases, formed by several nodules, sometimes with confluences.

Type three is the diffuse form, it is rare and it involves the whole liver.

The best method to detect the HCC nodules is MRI and the dynamic contrast give a lot of patterns to describe the lesion. Pseudocapsula if exist has to be differentiated by granulation tissue. Dysplastic nodules, smaller than 3 cm may enhance homogeneously, but tumors over 4 cm have a heterogeneously enhancement and may present necrosis and fibrous tissue. HCC have a specific pattern of enhancement after contrast administration, it has a strong enhance in the early in arterial phase and has a rapid "wash-out" on venous phase.

Some studies demonstrate that the role of CT in detection of the dysplastic nodules in the cyrotic liver is lower than MRI because the bloody supplies of the normal liver parenchyma is similar to that dysplastic nodules – fig 4 [20, 21].

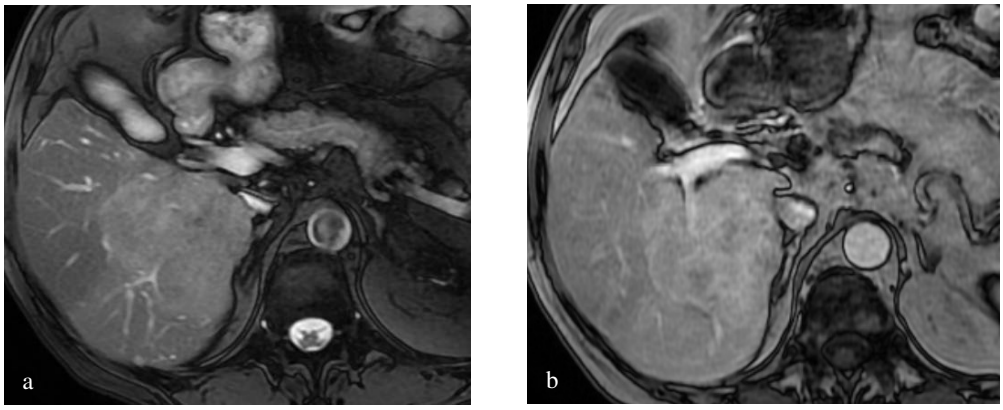

Fig 4- Hepatocellular carcinoma – 17 years old boy with HVB: a) T2 axial image – nodular HCC with portal invasion; b) inhomogenous enhancement after gadolinium.

Fibrolamellar carcinoma

It is a slow growing tumor and appears in adolescents

Appears in non-cyrotic liver with normal AFP levels.

The tumor vary from 5-20 cm, has calcifications and necrosis; it is well define, has central scar and radial septa. On the early phase after contrast media, the enhancement is diffuse; the scar and the septa enhance on delayed phased.

Differential diagnosis can be done with: focal nodular hyperplasia, conventional hepatocellular carcinoma. [29]

Undifferentiated embryonal sarcoma

It affected children between six and ten years [22] and also the adults [23]. Males and females are equal affected [24].

It is presented like a large mass, can reach 20 cm, well defined, often pseudoincapsulated and may contain cystic, hemorrhagic or necrotic areas; tumors with cystic components are more frequent than the solid and they have a rapid growth [25]; usually is symptomatic [26] and the levels of AFP from serum is normal [27].

On MRI the tumors appear like degeneration cystic, with hemorrhagic and necrotic areas; the septations and the pseudocapsule is in hypo signal on T1 and T2 and after contrast enhancement the stromal components and the septations are enhanced – fig 5. [11,28]

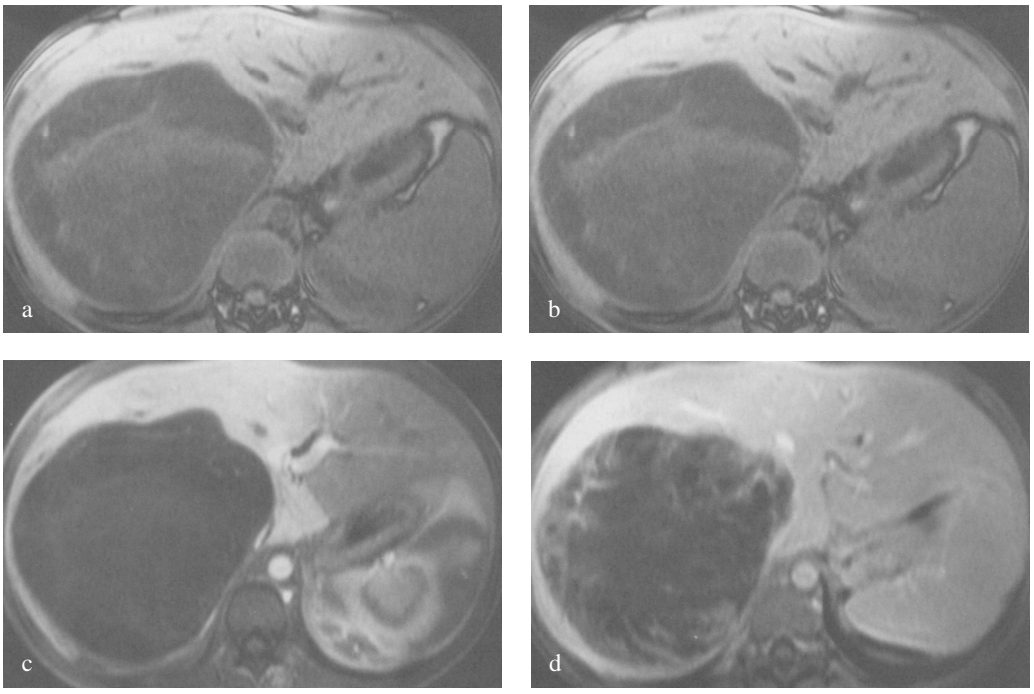

Fig 5 [13] – Undifferentiated embryonal sarcoma: a) coronal T2-weighted fat-sat suppressed show a large mass in high signal; b) axial T1-weighted without contrast; c) T1 wighted images after contrast images show in early phase a negligible enhancement; d) late-phase - moderate enhancement of the outer margins of the mass.

Conclusions

MR imaging is a fundamental tool for diagnostic in pediatric patients; et has a high accuracy and also an important role to determine the full extent of the hepatic lesions and also to evaluate the resecability in the preoperative stages.

MRI is preferred technique because has a better soft tissue contrast and for the lack of the ionizing radiation in comparison with computed tomography.

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Correspondance to:
Simona Cerbu,
Str. Dr. Iosif Nemoianu, Nr. 2
300011
Timisoara
Romania
Phone: 0749276265
E-mail: cerbusimona@yahoo.com