Challenges of radiological assessment in an infant with giant calcified hepatoblastoma

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Hepatoblastoma is a rare neoplasm of all pediatric cancers. The goal of treatment is to remove the tumor completely because cure without complete resection is extremely unusual. Accurate assessment of tumor resectability following preoperative chemotherapy is of crucial importance. It is sometimes difficult, especially when the tumor is as large and calcified as in the described case. Detailed radiological imaging such as computed tomography angiography or magnetic resonance angiography is the key for selecting the proper treatment method in hepatoblastoma during the preoperative period. In this article, we report a successfully treated giant calcified hepatoblastoma despite radiological assessment complexity.

Key words: hepatoblastoma, calcification, radiological assessment, computed tomography, magnetic resonance imaging, Doppler ultrasound.

Hepatoblastoma, the most common primary hepatic tumor in childhood, is a rare neoplasm, accounting for 0.8-2.0% of all pediatric cancers[1]. Radiological assessment of the lesion plays an important role in determining the treatment options. The probability of cure for hepatoblastoma is related strictly to the feasibility of achieving a complete mass resection[2]. Accurate assessment of tumor resectability following preoperative chemotherapy is of crucial importance. Here, we report an infant presenting with a giant liver tumor who was treated successfully in spite of imaging difficulties.

Case Report

An eight-month-old girl presented with an asymptomatic abdominal mass. Laboratory investigation showed thrombocytosis (1282 $x10^3/mm^3$), hypercholesterolemia (500 mg/dl), hypertriglyceridemia (1010 mg/dl), and a high level of alpha-fetoprotein (AFP) (>45,000 ng/ml). Spot urinary vanillylmandelic acid/creatinine ratio was normal. Abdominal ultrasound (US) and unenhanced computed tomography (CT) revealed a calcified, giant mass, originating from the left lobe of the liver (Fig. 1a). Magnetic resonance imaging (MRI) revealed signal loss areas within the mass, and portal hilar vascular structures seemed normal (Fig. 1b, c). Doppler US examination was unable to evaluate vascular invasion. On Doppler US, there was an acoustic shadowing artifact due to the heavily calcified tumor, neighboring the main vascular structures of the liver. Incisional biopsy confirmed a mixed-type hepatoblastoma. Histologically, the tumor contained areas of clear fetal-type epithelial cells growing in a trabecular and compact pattern, plus a mesenchymal component consisting of osteoid (Fig. 2a, b). The patient received two cycles of cisplatin (2.6 mg/kg) monotherapy according to the SIOPEL-3 standard-risk hepatoblastoma trial. Since the expected decrease in the patient's blood AFP level was not observed and there was an insufficient decline in tumor volume together with hepatic portal hilum release, we switched to PLADO (cisplatin + doxorubicin) regimen.

After a total of four courses of chemotherapy, preoperative follow-up CT scan revealed a large calcified mass occupying the portal hilus of the liver. Doppler US examination was not

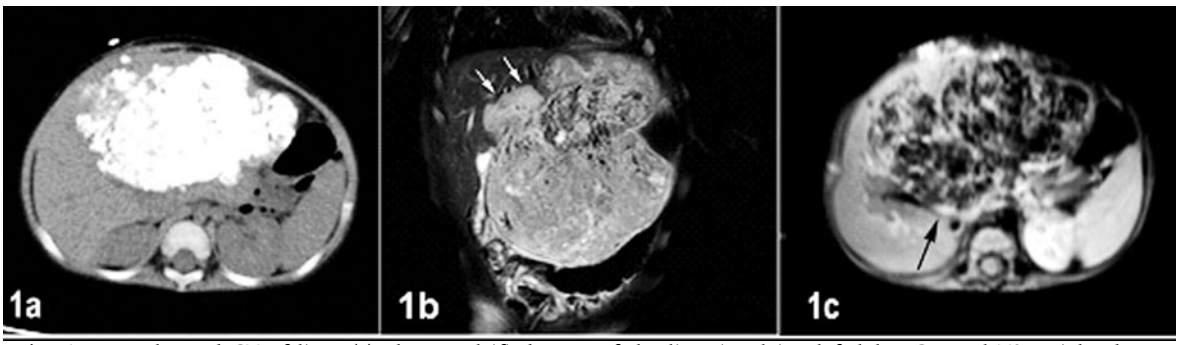

Fig. 1. Unanehanced CT of liver (a) shows calcified mass of the liver involving left lobe. Coronal T2 weighted MR image (b) demonstrates portal hilar involvement of the mass (arrows). Contrast enhanced T1 weighted MRI reveales (c) portal hilar compression with vascular displacement (arrows).

successful in evaluating vascular invasion. On Doppler US, there was an acoustic shadowing artifact due to the heavily calcified tumor, neighboring the main vascular structures of the liver. It was accepted as unresectable and was considered for possible surgery, including liver transplant. On surgical exploration, it was observed that the tumor was not related with the portal vascular structures and was easily resectable. Two additional courses of PLADO were administered after surgery. The patient has been in complete remission for three years.

Discussion

The treatment of hepatoblastoma is based on systemic chemotherapy and surgery. The goal of treatment is to remove the tumor completely, since cure without complete resection is extremely unusual[3]. Imaging is crucial in the assessment of children with hepatoblastoma at the time of diagnosis and during the preoperative period[4]. Gross pathologic appearance and histologic composition of a hepatoblastoma compose the imaging characteristics of the tumor. Mixed epithelial and mesenchymal hepatoblastomas represent the second broad histologic category and account for 44% of hepatoblastomas. In addition to fetal and embryonal epithelial elements, mixed tumors also contain primitive and differentiated mesenchymal tissues[5]. Most of these mixed tumors contain only fibrous, cartilaginous and osteoid-like material in addition to the epithelial component. Epithelial hepatoblastomas typically demonstrate a homogeneous appearance, while mixed epithelial and mesenchymal tumors appear more heterogeneous due to osteoid, cartilaginous and fibrous components[6]. On CT, the appearance of hepatoblastoma is seen as a sharply circumscribed mass that is slightly hypoattenuating relative to the adjacent liver parenchyma on unenhanced and contrast-enhanced images[7]. Epithelial hepatoblastomas demonstrate a more homogeneous appearance, while mixed tumors are more heterogeneous in attenuation. Although the prognosis largely depends on the staging at presentation, several other considerations have prognostic significance. Favorable prognostic factors include pure fetal histologic composition, which has a homogeneous mass density on imaging[7].

Speckled or amorphous calcification is seen in more than 50% of lesions[8]. Abdominal radiographs generally demonstrate hepatomegaly or a mass with or without coarse or dense calcifications, which frequently correspond to the presence of osteoid material in mixed tumors[8]. On US, the appearance depends on the histological type. Overall, hepatoblastomas are most often hyperechoic relative to the adjacent liver. Dense calcification areas within the tumor make US examination difficult and inconclusive. In our case, the liver lesion was heavily calcified, which appeared as a very dense mass on unenhanced CT examination. It is sometimes not possible to locate the origin of the calcified abdominal mass with radiological imaging techniques, especially when it is as large as in the described case. Differential diagnosis of upper abdominal calcified abdominal masses includes mesenchymal hamartomas, teratomas of the liver and neuroblastomas[3].

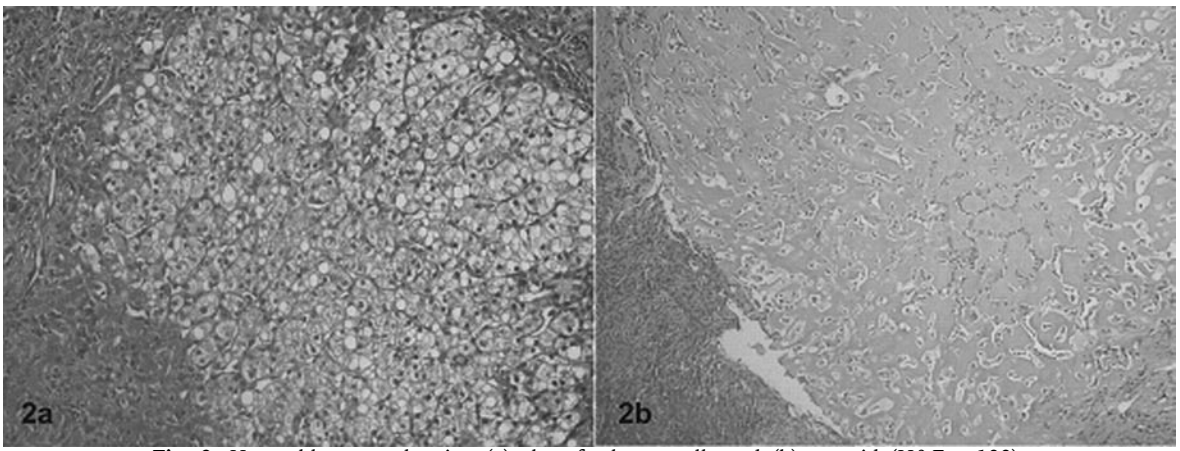

Fig. 2. Hepatoblastoma showing (a) clear fetal-type cells and (b) osteoid (H&E x 100).

Mixed tumors demonstrate more heterogeneous signal intensity on MRI. Calcifications, which are more common in mixed tumors, are not visualized well on MRI[9]. MR angiography (MRA) is useful to evaluate the hepatic vasculature preoperatively[8,9]. Tumors involving the hepatic hilum are not thought to be resectable because of the high risk of unmanageable hemorrhage during the operation[10]. In addition, detection of the presence of tumor involvement on major vessels may be difficult. Portal vein invasion is often best detected by Doppler US[11-13]. The acoustic shadowing artifact of the heavily calcified tumor on Doppler US examination made it insufficient to evaluate the vascular patency of the portal vein. MRI seemed unable to demonstrate the complete portal vascular patency. As angiography is an invasive procedure, its use in children is limited. Although MRA or multislice CT angiography (CTA) with reformatted and 3-dimensional (D) reconstructed images are important tools to delineate vascular patency, CTA has radiation dose issues, while MRA has limitations of breathing artifacts together with adequate sedation, especially in infants[14].

The SIOPEL 3 standard-risk hepatoblastoma trial demonstrated that cisplatin monotherapy achieved similar rates of complete resection and survival among children with standard-risk hepatoblastoma, compared with cisplatin plus doxorubicin[15]. If we had proper and accurate chemotherapy response with detailed preoperative radiological evaluation, we might have avoided doxorubicin and referred the patient to a transplantation center. To determine the treatment strategy for hepatoblastoma, appropriate radiological evaluation is needed. Detailed radiological imaging such as CTA or MRA is the key for selecting the proper treatment method in hepatoblastoma during the preoperative period.

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