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Follow-up imaging of benign pediatric liver tumors

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Abstract. Though surgery has been recommended in the past for the management of benign hepatic tumors, the current emphasis is on medical management. This report of 4 cases with long-term (8–28 months) follow-up emphasizes the natural history of these tumors which serves to indicate the advantages and disadvantages of CT and ultrasound. The lesions typically involute with some calcification. Calcification can technically be a problem in follow-up with sonography.

Surgical management has been recommended for benign pediatric liver tumors in the past [1]. More recently, medical management of benign tumors has been advocated [2]. Symptoms, if present, can often be managed medically, and the progression of the tumor can be effectively monitored with the newer imaging modalities. CT and ultrasound have received attention in the literature in the diagnosis of benign liver tumors. Imaging characteristics have been described [3–5]. However, the long-term follow-up and natural course of the diseases have not been emphasized.

Four patients with benign liver tumors (one hemangioendothelioma and three mesenchymal hamartomas) have been followed at our institution over a period of 8–28 months. The natural history of the tumors on ultrasound and CT is reported.

Case 1

At one day of age an infant boy with circumoral cyanosis and tachypnea had chest radiographs that showed mild pulmonary congestion and marked cardiomegaly. A small focus of calcification was noted in the left upper quadrant. Abdominal ultrasound demonstrated a large mass in the left lobe of the liver containing tortuous vascular spaces, and areas of dense echogenic foci characteristic of calcification (Fig. 1a). The proximal aorta, celiac axis, hepatic artery and left hepatic vein were markedly dilated. Angiography confirmed the diagnosis of a benign, vascular lesion, presumably, hemangioendothelioma.

Diuretic therapy was instituted, and within 10 days, the patient had no evidence of tachypnea or heart failure. He was discharged and abdominal ultrasound studies 5 weeks later revealed no change in the size of the mass, but did show decreased dilatation of the aorta adjacent to the mass. Ultrasound studies at 2 months, 12 weeks, and 13 months revealed involution of the mass with only a tiny remaining cluster of calcification (Fig. 1b, c).

Case 2

A 12-month-old boy was discovered to have a hard right upper quadrant mass during a routine physical examination. Ultrasound studies revealed an intrahepatic solid mass $5 \times 6 \times 5.5$ centimeters in size, involving both the right and left lobes, containing a central hypoechoic area with multiple internal echoes. CT confirmed these findings (Fig. 2a). Hepatoblastoma was a consideration in this patient and an exploratory laparotomy was performed. Biopsy revealed a benign mesenchymal hamartoma which was not resected in accordance with the parents' religious beliefs against blood transfusion. The child has been followed without therapy.

The boy was evaluated by CT and ultrasound 1 month later and no change was identified. At 20 months of age the ultrasound examinations showed a large amount of calcification in the region of the mass which on follow-up studies has made accurate measurement of the lesion difficult (Fig. 2b). The most recent CT examination, 28 months since diagnosis, revealed the calcification and documented some decrease in size of the lesion (Fig. 2c). The patient has remained asymptomatic.

Case 3

A 4-day-old boy was transferred to our hospital with a large right upper quadrant mass discovered on newborn physical examination. Both ultrasound and CT demonstrated a $5 \times 6 \times 8$ centimeter septated mass with fluid filled cystic regions involving both lobes of the liver. The diagnosis of mesenchymal hamartoma was made and the child has been followed without therapy. Follow-up examination with ultrasound and CT at 9 weeks and 8 months of age demonstrated some involution of the mass by decrease of overall size. This was best documented on CT since the size of the lesion initially precluded including the entire mass in the scanning field in ultrasound. The patient has remained asymptomatic.

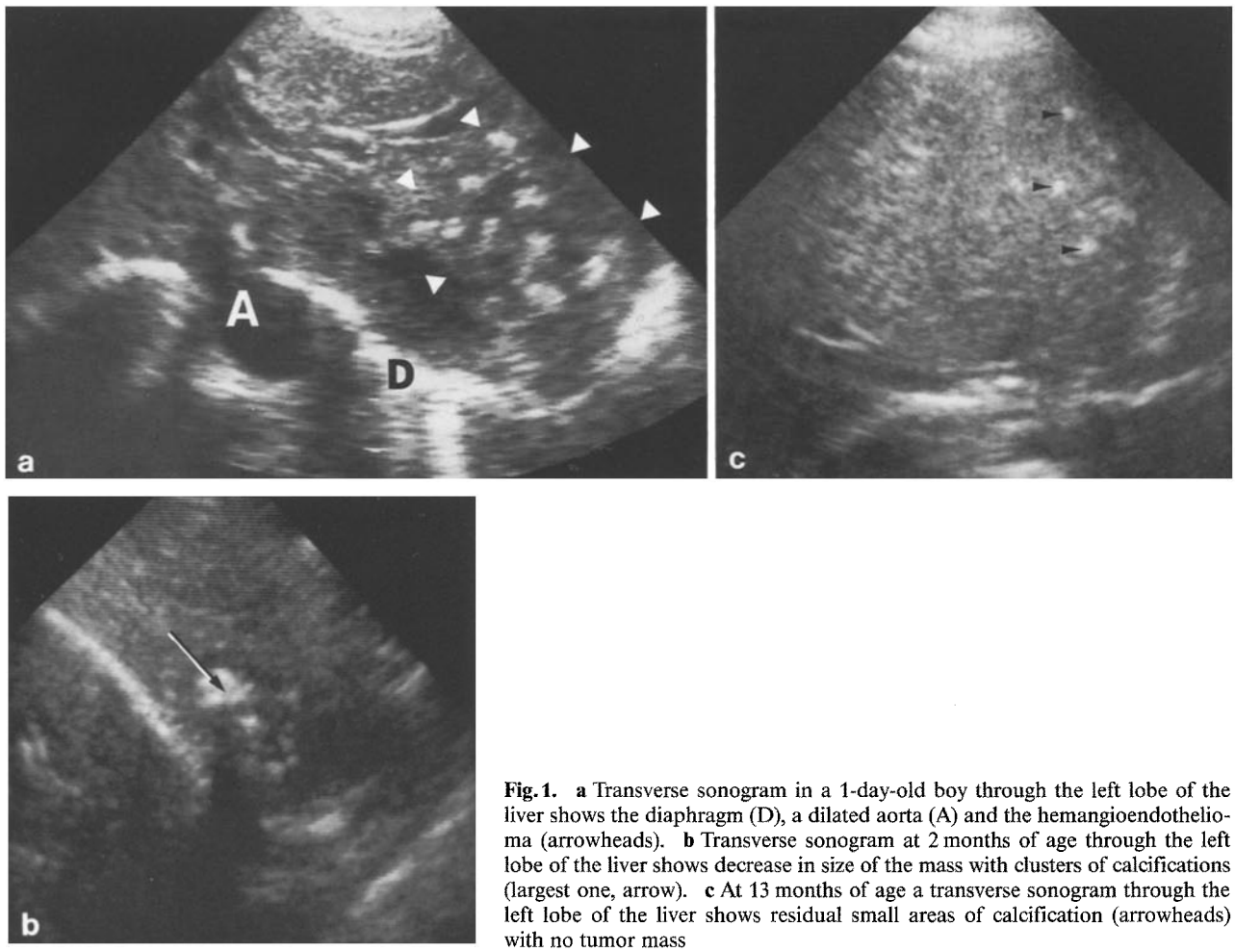

Fig. 1. **a** Transverse sonogram in a 1-day-old boy through the left lobe of the liver shows the diaphragm (D), a dilated aorta (A) and the hemangioendothelioma (arrowheads). **b** Transverse sonogram at 2 months of age through the left lobe of the liver shows decrease in size of the mass with clusters of calcifications (largest one, arrow). **c** At 13 months of age a transverse sonogram through the left lobe of the liver shows residual small areas of calcification (arrowheads) with no tumor mass

Case 4

A 2-month-old boy was found to have a large right upper quadrant mass on physical examination. Both CT and ultrasound revealed a $6.5 \times 5 \times 5$ centimeter solid mass in the right lobe of the liver. Since hepatoblastoma was a consideration, the child had an exploratory laparotomy. Biopsy revealed a mesenchymal hamartoma with hemangioendothelial components which was not resected in accordance with the parents' religious beliefs against blood transfusion. The child has been followed without therapy. CT studies 3, 5, and 11 months following diagnosis revealed marked decrease in size of the lesion with extensive calcification. The patient has remained asymptomatic.

Discussion

Distinctive sonographic and CT appearances of benign liver tumors as published in the literature are helpful in the diagnosis of mass lesions in the liver [3–5]. However, the variety of presentations for each of these tumors can present diagnostic difficulties. For example, the mesenchymal hamartomas in cases 2 and 4 were solid (Fig. 2) rather than the usual more septated cystic appearance [3]. In each case surgical biopsy was required to eliminate the diagnosis of malignant neoplasm. Though medical management may be advocated, surgical biopsy may often be necessary. Surgical resection for benign liver tumors is now largely reserved for complications and failures in medical management [3].

The natural history of hemangioendothelioma is spontaneous regression in early life [2]. The natural history of mesenchymal hamartoma is not well documented since the majority of these benign tumors were surgically removed until recently. In all four of our cases the natural history included involution in overall size of the lesions accompanied by extensive calcification in three patients. The extensive calcification can limit the ultrasound examination. In addition, when the size of the lesion is so massive that it cannot be assessed in one frame window, real-time scanning measurements can be difficult to replicate at follow-up studies. Though ultrasound continues to have the advantage of easy accessibility, no radiation and no need for sedation, the

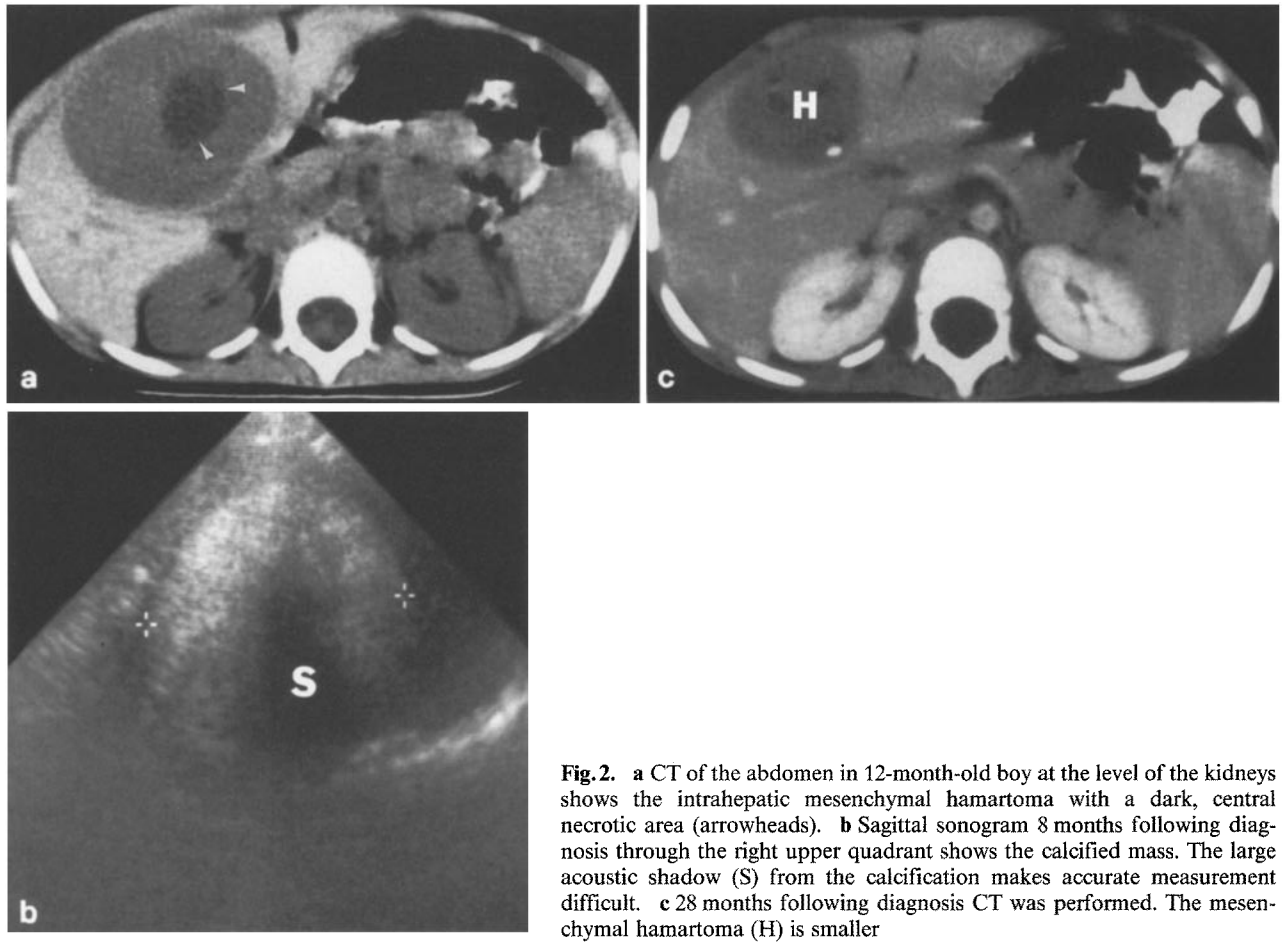

Fig. 2. **a** CT of the abdomen in 12-month-old boy at the level of the kidneys shows the intrahepatic mesenchymal hamartoma with a dark, central necrotic area (arrowheads). **b** Sagittal sonogram 8 months following diagnosis through the right upper quadrant shows the calcified mass. The large acoustic shadow (S) from the calcification makes accurate measurement difficult. **c** 28 months following diagnosis CT was performed. The mesenchymal hamartoma (H) is smaller

long-term follow-up as demonstrated by these cases presents a challenge. CT in this age group requires sedation, patient bowel preparation, and intravenous contrast. However, the calcifications do not interfere with the study and the overall size of the lesion when they are very large can be easily compared to previous studies. The long-term follow-up of benign liver tumors requires the complementary imaging modalities of ultrasound and CT to be individualized in each patient situation.

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