

Percutaneous radiofrequency ablation for treatment of hepatoblastoma recurrence

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Abstract Radiofrequency ablation (RFA) has been widely reported as a minimally invasive treatment for liver tumours in adults, but has not been documented as a treatment for hepatoblastoma in a child. We report a 2-year-old boy with local recurrence of hepatoblastoma after partial hepatectomy. Percutaneous RFA was performed under real-time sonographic guidance. There was no imaging evidence of recurrence after a follow-up of 2 years. We consider this a promising technique in children.

Keywords Hepatoblastoma · Radiofrequency ablation · Child

Introduction

Hepatoblastoma is the most common hepatic cancer in childhood. With complete surgical resection and chemo-

therapy the prognosis has significantly improved over the past decade and 5-year survival is now over 70% [1]. Despite this improvement, the outcome for patients with recurrent disease continues to be dismal. Therefore, there is a need for new therapeutic options that will improve the survival rate of these patients. We report a 2-year-old boy with local recurrence of hepatoblastoma after surgical resection and chemotherapy. Percutaneous radiofrequency ablation (RFA) was successfully performed with a satisfactory outcome.

Case report

A 1-year-old boy was diagnosed with hepatoblastoma. Surgical resection of the right posterior lobe and left medial lobe of the liver was performed after biopsy and three transcatheter arterial chemoembolization (TACE) procedures. The serum α -fetoprotein (AFP) level decreased from >1,210 ng/ml to 26 ng/ml and remained normal (3.7 ng/ml) after systemic chemotherapy. A US scan performed 12 months later revealed a 10-mm hypoechoic area in the left lateral lobe of the liver (Fig. 1). CT confirmed a single low-attenuation lesion that did not exhibit contrast enhancement. The serum AFP level was mildly elevated to 56 ng/ml and a local recurrence was diagnosed.

Considering the age and nutritional state of the child, RFA was regarded as an alternative to surgical resection. RFA was performed percutaneously under real-time US guidance (LOGIQ 500, GE Medical Solutions, Milwaukee, WI). After induction of local anaesthesia and deep sedation, an 18-gauge, cooled-tip electrode (HiTT needle electrode; Integra, Plainsboro, NJ; diameter 1.2 mm, shaft length 100 mm, electrode length 10 mm; the smallest needle electrode in the range) with an exposed tip of 2.0–3.0 cm

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Fig. 1 US image reveals a small hypoechoic recurrence (*arrows*) in the left lobe of the liver

was placed into the target lesion. A 480-kHz radiofrequency (RF) generator (RITA 1500 Generator; Rita Medical Systems, Fremont, CA) delivering a maximum power of 50 W was used for thermal ablation. Circuitry in the generator allows continuous monitoring of impedance between the active part of the cooled needle and the grounding pads placed on the patient's thigh. A thermocouple embedded in the electrode ensures constant monitoring of the temperature at the tip of the needle. At the onset of ablation the tumour became completely hyperechoic on US; as ablation progressed the region of hyperechogenicity spread to a surrounding rim of 0.5–1.0 cm of normal hepatic tissue (Fig. 2). Two 10-min phases at maximum temperature were performed and the tip of the needle was cooled after ablation. At the end of the procedure, the needle track was treated by thermocoagulation. The RFA was considered technically successful.



Fig. 2 US image obtained immediately after completion of treatment shows a hyperechoic area at the original tumour site

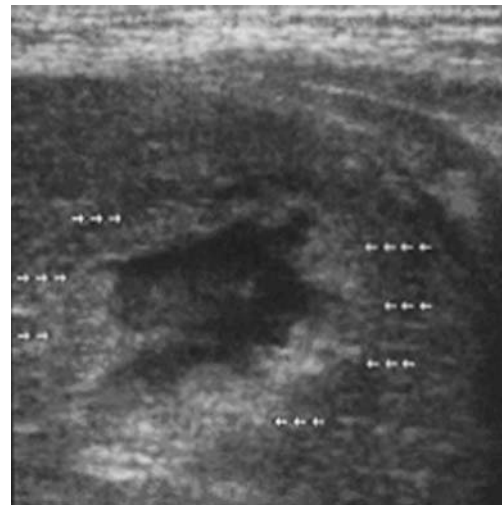


Fig. 3 US image obtained 1 week after RFA reveals a hypoechoic area with surrounding hyperechogenicity

The child underwent routine follow-up to monitor for tumour recurrence by monthly testing of serum AFP level and by imaging with US or CT every other month. One week after RFA, US revealed a hypoechoic area with surrounding hyperechogenicity (Fig. 3). The hypoechoic area did not enhance on contrast-enhanced CT and was considered to represent necrosis (Fig. 4). The serum AFP level was 3.73 ng/ml. After 1 month, US revealed a 30-mm hypoechoic area in the left lobe of liver with no Doppler flow and no enhancement on CT. By 2 months the size of the area of RF-induced coagulation necrosis had reduced. The child was in good condition, his haemoglobin had increased, and his AFP level remained stable in the normal range. At the time of this report, the follow-up period following RFA was 2 years without local recurrence or distant metastasis.

Discussion

A RF current converted into heat through ion agitation and friction can destroy liver tumour by means of coagulation necrosis. The use of percutaneously advanced needle

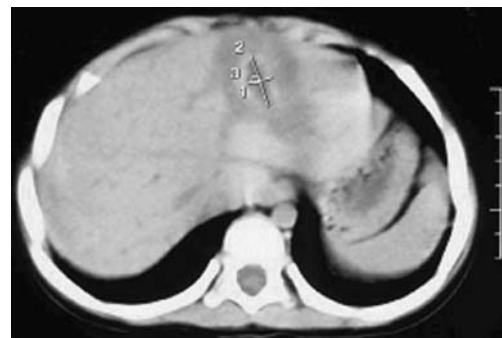


Fig. 4 CT image obtained 1 week after RFA

electrodes for the application of RF energy provides the potential for high clinical response with low morbidity and mortality [2, 3]. RFA has been widely reported as a useful minimally invasive treatment for liver tumours in adults [4–6], but not in children [7], and its use for the treatment of hepatoblastoma recurrence has never been reported.

The child reported here underwent contrast-enhanced CT and US before and after RFA. In our management protocol, any irregular, peripherally enhancing focus in the ablation zone would have been considered to represent residual nonablated tumour that was unresponsive to RFA, and TACE would be performed. If the tumour responded completely to RFA and no new nodules were found by CT or US at the 1-month follow-up, CT would be repeated at intervals of 2–4 months. The technique was to be considered effective if follow-up CT more than 1 year after RFA showed no enhancing foci in the ablation zone, indicating that tumour necrosis had been complete. At the time of this report the child showed no enhancing foci in the ablation zone on CT 2 years after RFA—a very satisfactory outcome.

Previous reports have shown that RFA has the best results in small nodular tumours [8]. Because of minimally invasive local treatment, RFA can achieve satisfactory outcomes for small liver tumours, and has become an effective and relatively safe alternative for the treatment of advanced tumours and recurrent tumours that are not suitable for traditional therapy. In addition to destroying tumour tissue, RFA induces an immune response against tumour antigens [9] and the expression of heat shock proteins is significantly increased by RFA [10, 11]. The ease of use and minimal invasiveness of the procedure make RFA preferable to other techniques [12]. We consider this technique to be promising in children. In combination with intervention, hepatectomy and chemotherapy, RFA is a reliable and effective therapy in the treatment of children with hepatoblastoma or recurrence after hepatectomy.

For follow-up, we consider CT is less useful (1) because US is easier in children than in adults, (2) because AFP is a very sensitive tumour marker in hepatoblastoma, and (3) because of the radiation risk.

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