Rapid Microwave Ablation of Large Hepatocellular Carcinoma in a High-risk Patient

Andrew D. Strickland, Peter J. Clegg, Nigel J. Cronin, Mosheir Elabassy and David M. Lloyd, Departments of Hepatobiliary Surgery and Radiology, Leicester Royal Infirmary, Leicester, and Medical Devices Technology Group, University of Bath, Claverton Down, Bath, United Kingdom.

A 74-year-old male with an inoperable, large (6 cm in diameter) primary hepatocellular carcinoma of the liver was successfully treated using a novel microwave ablating system. Using a single applicator, the tumour was treated at 150 W for 4 minutes. An ablation zone 8 cm in diameter was achieved, which gradually shrunk to form scar tissue that remained unchanged without tumour recurrence for 2 years. [Asian J Surg 2005;28(2):151–3]

Key Words: hepatocellular carcinoma, microwave ablation

Introduction

Hepatocellular carcinoma (HCC) is a worldwide problem, with over 400,000 cases diagnosed in 1990. Treatments include surgical resection, local ablation or even liver transplantation, yet only a minority of patients are suitable for treatment due to comorbidity, cirrhosis and a shortage of donor livers. Ablation of HCC offers an attractive alternative to surgical resection as more hepatic parenchyma is spared, although many ablative techniques are hampered by protracted treatment times and an inability to treat large tumours. A case is hereby presented where a high-risk patient with a large HCC was treated rapidly and effectively using a novel microwave applicator.

Case report

A 74-year-old man with known cirrhosis (Childs-Pugh class A) presented with a history of vague right upper quadrant pain. Ultrasound and magnetic resonance imaging (MRI) revealed a tumour measuring 6 cm within the right lobe of the liver. The tumour's radiological features in conjunction with a raised α-fetoprotein (AFP) level of 5,814 Ku/L suggested an HCC, which was initially considered to be resectable. Preoperatively, the patient had mild renal and hepatic dysfunction (serum urea 13.1 mmol/L, creatinine 192 μmol/L, alkaline phosphatase 274 IU/L, aspartate aminotransferase 76 IU/L, alanine aminotransferase 77 IU/L, γ-glutamyl-transferase 835 IU/L, albumin 34.5 g/L, bilirubin 20 μmol/L and international normalized ratio 1.3).

At laparotomy, a large tumour mass was confirmed and was considered inoperable because a formal right hemi-hepatectomy would have been necessary. A newly designed 6.7-mm diameter microwave applicator (probe) was inserted into the tumour and a 4-minute, 150 W treatment administered. Thermocouples were placed into the tissue approximately 0.5–1 cm beyond the tumour margins to ensure that cytotoxic temperatures were achieved. During the microwave treatment, the patient remained stable and no adverse effects were observed. Following treatment, the microwave applicator was removed without haemorrhage. Histology of a biopsy taken at the time of the procedure confirmed the lesion to be an HCC.

The patient made an uneventful postoperative recovery with no evidence of a systemic inflammatory response-type syndrome and AFP levels fell to 55 Ku/L (Figure 1). Six weeks after surgery, MRI showed that the tumour had been com-
hepatic inflow occlusion have increased lesion size to approximately 2 cm in diameter after 10–15 minutes. Current microwave treatment of large tumours involves multiple punctures and repeated treatments in an attempt to ablate the entire lesion. The new microwave applicator used in this patient is unique as it can produce large-volume ablations through the use of newly developed material elements in the emitting portion of the device. The new applicator design was able to withstand the use of high powers while minimizing reflection at the tissue/applicator interface. Considerable reflection of power and heat at the applicator/tissue interface during microwave treatment, previously thought to be inevitable and limiting, was greatly reduced with this equipment. Moreover, the large volume of tumour necrosis was achieved in only 4 minutes without complications. This was of crucial importance, particularly in this high-risk, unstable patient who could not have withstood a prolonged ablative procedure.

This is the first report of a high-risk patient with a large HCC within a cirrhotic liver treated with the novel ceramic microwave applicator. The ability of this system to produce rapid and complete ablation of such a large tumour marks an encouraging advance in microwave ablation technology. The use of a rapid and effective ablation technique such as this is an attractive option, particularly in unstable high-risk patients who would not be able to withstand alternative and prolonged ablative treatments.

Discussion

Only a minority of patients with HCCs can be treated using surgical resection alone, and the treatment of large lesions in particular remains a challenge. Many ablative techniques, from cryotherapy, radiofrequency and microwave ablation to percutaneous ethanol injection, laser thermotherapy and focussed ultrasound, are currently being investigated worldwide. Laser thermotherapy and percutaneous ethanol injection, for example, have limited use as treatment results in patients with large tumours are disappointing despite repeated treatments. Radiofrequency ablation has become an acceptable ablation modality as advances in needle design have allowed greater ablation volumes to be achieved. Results in terms of ablation completeness in patients with larger lesions, however, remain disappointing, with fewer than 50% completely ablated. Cryotherapy has the ability to ablate large lesions, although the risk of the often fatal cryoshock phenomenon or major haemorrhage increases when larger volumes of tissue are treated.

Previous microwave applicators have had limited effect in the treatment of HCCs larger than 2 cm in diameter due to the small ablation volume produced following a single insertion of the probe. Attempts to increase the ablation volume using
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References