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CASE REPORT

Laser Thermal Ablation of Small Renal Cell Carcinoma in a Patient with Coagulation Impairment: A Case Report

Sergio Sartori*, Francesca Di Vece, Francesca Ermili, Lara Bianchi, Giacomo De Paoli Barbato and Paola Tombesi

Section of Interventional Ultrasound, St. Anna Hospital, Italy

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Correspondence:
Dr. Sergio Sartori,
Section of Interventional Ultrasound, St. Anna Hospital, Italy, Tel: 39 0532239480;
Fax: 39 0532239613;
Email: srs@unife.it

ABSTRACT

Radiofrequency Ablation (RFA), Cryoablation (CRA) and Microwave Ablation (MWA) are gaining an increasing role in the treatment of patients with Stage T1a Renal Cell Carcinoma (RCC) who are unsuitable for surgery. Laser Thermal Ablation (LTA) is an effective technique to treat liver tumors, and uses needles with smaller diameter than RFA, CRA, and MWA devices. We report a case in which LTA was successful in the treatment of a small RCC in a patient with coagulation impairment.

Introduction

In the last decade ablation therapy is gaining an increasing role in the treatment of patients with Stage T1a Renal Cell Carcinoma (RCC), who are unsuitable for surgery. Recently, the Cardiovascular and Interventional Radiology Society of Europe (CIRSE) recommended Radiofrequency Ablation (RFA) and Cryoablation (CRA) as the most suitable ablation modalities, and mentioned Microwave Ablation (MWA) as a promising technique, even though some concerns exist about its higher risk of pelvicalyceal injury [1]. However, there is a third hyperthermia-based ablation technique, which uses laser optical fibers to deliver high-energy laser radiation to the tissue [2] and is currently used in many centers to treat primary and metastatic liver cancers with results that are comparable to MWA and RFA [3-6]. The technique proposed by Pacella [4] and modified by Di Costanzo [5] for Laser Thermal Ablation (LTA) of liver tumors uses needles with smaller diameter than RFA electrodes and MWA antennas, and such a peculiarity has been claimed to give some advantages in particular clinical settings [2,5]. However, to date LTA is not currently used in the treatment of RCC, and the experiences in renal ablation are small and sporadic [7-9].

We report a case of successful LTA of a small RCC in a patient with impairment of coagulation parameters.

Case Presentation

A 52-year-old man with HIV infection and hepatitis C-related liver cirrhosis was referred to our Section of Interventional Ultrasound after Ultrasonography (US) performed for hepatocellular carcinoma surveillance had incidentally detected a hypoechoic nodule 14 x 12 mm in size in the right

kidney. Contrast-Enhanced Computed Tomography (CECT) confirmed a 14-mm slightly enhancing nodule in the anterior renal rim (Figure 1), and also Contrast-Enhanced Ultrasonography (CEUS) depicted slight enhancement of the nodule in the arterial phase followed by wash-out in the venous phase (Figure 2a and 2b). On the basis of these imaging findings, the nodule was considered highly suspicious for RCC. The patient was judged unsuitable for surgery by a panel of experts that included the urologist, anesthesiologist, oncologist, and interventional radiologist, and he was referred for thermal ablation. Pre-procedural laboratory tests showed low platelet count ranging from 40000 to 50000 platelets/mcL, and increased International Normalized Ratio with INR value of 1.8 that decreased to 1.6 after vitamin K supplementation, but remained over the threshold of 1.5 that is recommended for interventional procedures at high risk of bleeding such as renal biopsy and RFA ablation [10]. The coagulation impairment made advisable to perform thermal ablation using needles as fine as possible, so LTA was judged preferable to RFA or MWA in this case, as it enables to use 21-gauge needles that are considerably thinner than the cool-tip RFA electrodes (17 gauge) or MWA antennas (14-16 gauge).

LTA was performed on an inpatient basis by using a commercially available system composed of an US device and a laser unit (Echolaser, Elesta Srl, Florence, Italy). The laser source is a semi-conductor diode with a wavelength of 1064 nm. The system uses 300□m bare optical fibers introduced into the tumor through 21-gauge needles (Figure 3), and a multi-source device enables the use of up to four fibers at once (Figure 4). A bare-tip fiber provides an almost spherical thermal lesion of about 12 mm in diameter: using from one to four fibers, it is possible to obtain ablation areas up to 4 cm in diameter, according to the tumor size. After local anesthesia with lignocaine 1% 10 mL and conscious sedation with intravenous midazolam and ramifentanil, two laser fibers spaced 12 mm each other were introduced into the tumor under US guidance. The laser machine was set at a power of 5 W, and 1800 J per fiber were delivered in six minutes. CEUS performed 10 minutes after the end of LTA depicted a nonenhancing area of 18 x 14 mm completely covering the target tumor (Figure 5), and the treatment was considered complete.

The patient was kept in the hospital overnight and had its vital signs monitored. The next morning he had clinical evaluation, laboratory tests, and US examination of the abdomen. The patient was well, laboratory tests showed normal red blood cell count and renal function, US examination excluded renal or perinephric hematomas, and he was discharged in the afternoon. CECT performed three months after LTA documented disappearance of the renal tumor that had been replaced by a nonenhancing 11-mm fibrotic thickening (Figure 6). At present, 22 months after LTA, the patient is alive and disease-free.

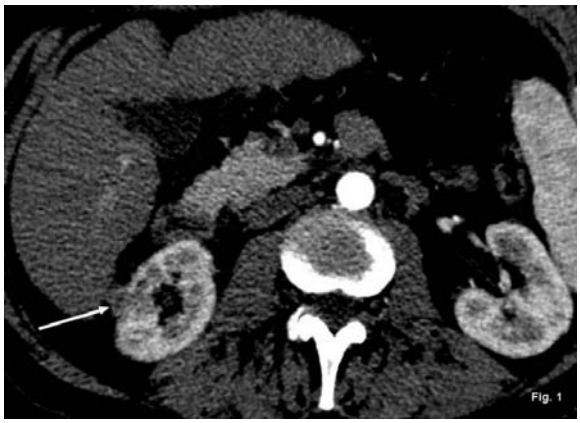

Figure 1: CECT scan showing a partially exophytic, slightly enhancing nodule 14 mm in size in the anterior rim of the right kidney (arrow).

Discussion

Percutaneous ablation represents an alternative to partial nephrectomy for the treatment of stage T1a RCC in patients who are not fit or are not willing to undergo surgical treatment, with excellent long-term technical and functional outcome and a very low complication rate [1]. RFA and CRA are the most extensively used and studied ablation techniques, and in the last years MWA is also increasingly used for the treatment of RCC, as it enables to obtain larger ablation areas than RFA even though it seems to have higher risk of pelvicalyceal injury [1].

LTA uses laser optical fibers to deliver energy laser radiation to the tissue. Because of light absorption,

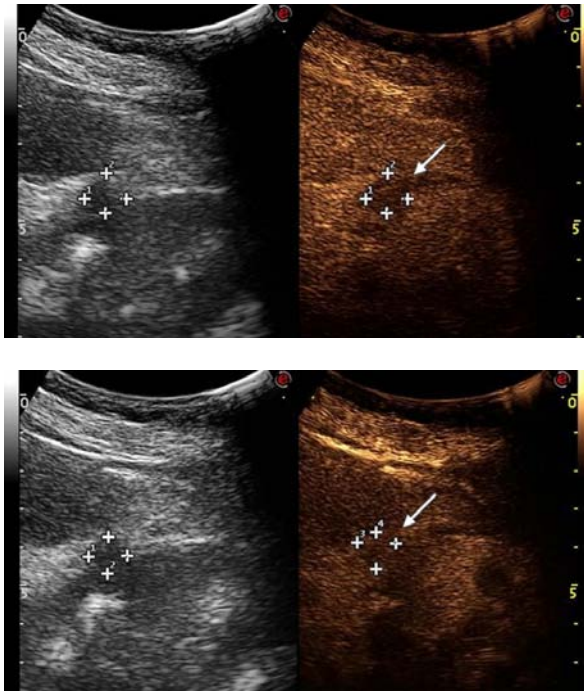

Figure 2: CEUS scan of the right kidney showing slight contrast-enhancement of the nodule in the arterial phase (2a, right side of the split screen) (arrow), and wash-out in the venous phase (2b, right side of the split screen) (arrow).

Figure 3: 300 □m laser fiber (arrow) introduced into a 21-gauge Chiba needle.

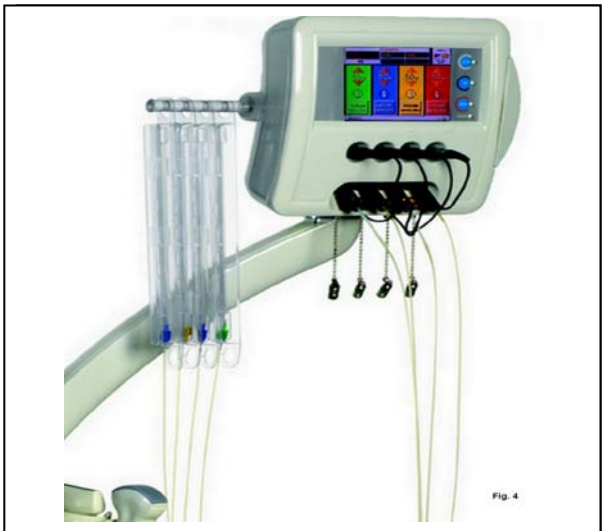

Figure 4: Laser ablation machine with multi-source device.

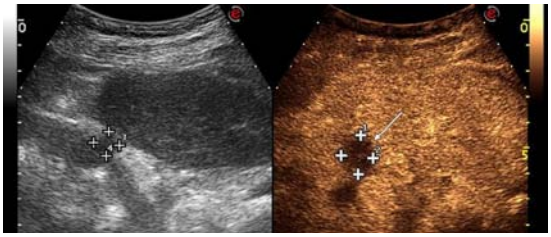

Figure 5: CEUS scan performed 10 minutes after the end of LTA showing a nonenhancing area of 18 x 14 mm completely covering the target tumor (right side of the split screen) (arrow).

Figure 6: CECT scan performed three months after LTA showing disappearance of the renal tumor that is replaced by a nonenhancing 11-mm fibrotic thickening (arrow).

temperatures of up to 150° C are reached, leading to coagulative necrosis [2]. Even though less investigated than RFA and MWA, LTA is widely used in the treatment of primary and secondary liver tumors with excellent results [2-6], and two randomized trials did not find any significant difference between RFA and LTA in terms of local tumor control, overall survival, and safety [6,11]. At present, LTA is not currently used to treat RCC, and the few studies reported in literature involved very small series of patients and used large diameter devices requiring the introduction of a 9 French sheath into the tumor [7-9]. Conversely, the technique we employed to treat our patient uses 21-gauge needles to introduce 300 □m optical fibers into the tumor [4,5]. The kidney is a hypervascular organ and is considered more at-risk of bleeding than the liver when interventional procedures are performed [10], and needle size has been reported to be a risk factor of post-procedural haemorrhage

[12]. Therefore, the use of needles with smaller diameter than RFA, MWA, or CRA devices could have some advantage when thermal ablation is performed to treat RCC, in particular if the risk of bleeding is increased. Although our patient had platelet count and INR values lower than those recommended for interventional procedures with high risk of bleeding such as thermal ablation [10], he had no minor nor major complications and could be discharged the day after LTA. The procedure was successful and the patient is alive and disease free after a follow up of 21 months. Although the length of the follow up is still relatively short, the majority of recurrences after RFA of RCC have been reported to occur within the first 24 months after the procedure, with a significant number being diagnosed within the first 3 months [13]. Therefore, it is likely that the 21-month follow up is long enough to infer a good long-term efficacy of LTA in our patient.

Conclusion

To the best of our knowledge, there are no studies in literature reporting the outcomes of other ablation therapies, such as RFA, MWA, and CRA, in patients with coagulation impairment comparable to that of our patient. Indeed, platelet count lower than 50000 platelets/mcL and INR higher than 1.5 are usually considered contraindications to percutaneous thermal ablation [10,14]. Therefore, the preference for LTA in patients with coagulation impairment is grounded on the logical premise that thinner needles are less likely to cause bleeding than larger needles [12], but no comparison with other prior experiences can be made.

Nevertheless, this case report suggests that US-guided percutaneous LTA of small RCC seems to be a safe and effective procedure. If confirmed by some prospective trials, LTA could represent a valid alternative to RFA, CRA, or MWA in the treatment of Stage T1a RCC, in particular in patients at increased risk of bleeding.

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