P6

EUS-GUIDED Nd:YAG LASER ABLATION OF AN HEPATOCELLULAR CARCINOMA

F. Di Matteo (1), R. Grasso (2), C.M. Pacella (3), M. Martino (1), M. Pandolfi (1), R. Rea (1), S. Silvestri (4), E.Zardi (5) and G. Costamagna (6)

[1] Digestive Endoscopy Unit , Campus "Bio-Medico" University of Rome; [2] Radiology Unit, Campus "Bio-Medico" University of Rome; [3] Radiology Unit, Regina Apostolorum Hospital, Albano; [4] Faculty of Biomedical Engineering, Campus "Bio-Medico" University of Rome; [5] Clinical Medicine, Campus "Bio-Medico" University of Rome; [6] Surgical Endoscopy Unit, "A. Gemelli" Catholic University of Rome;

Introduction.
Surgical resection or transplantation have in the past been considered the gold-standard for treatment of hepatocellular carcinoma (HCC). The overall respectability rate for such lesions is very low due to a combination of underlying chronic liver disease, lesion location and multifocal nature of HCC. In an attempt to conserve the hepatic parenchyma and in those cases where surgery is not indicated, loco-regional procedures have been used. In the last decade laser ablation (LA) and radiofrequency ablation (RFA) are the two most widely used of these. These techniques are cost effective in comparison to other treatments and are able to preserve the surrounding liver parenchyma whilst minimizing in-patients hopsitalization. The most widely used device for LA techniques is the Nd:YAG (neodymium: yttrium-aluminium-garnet) laser with a wavelength of 1064 nm, because penetration of light is optimal at the near-infrared range of the spectrum.
A range of different imaging modalities have been used to guide percutaneous LA techniques like ultrasound (US), magnetic resonance (MR) and unlike computed tomography (CT). This is a report of the first case of EUS-guide Nd:YAG laser ablation of a hepatocellular carcinoma, the location of which precluded percutaneous treatment.

Materials and Methods.
In July 2009 a 67-year-old man with multifocal hepatocellular carcinoma (HCC) in criptogenetic liver cirrhosis Child-Pugh A5, with portal hypertension, splenomegaly, was submitted to transcutaneous arterial embolization with particles (40micron Embozene ™ microspheres, CeloNova BioScience, Inc. Newnan, Georgia, USA) combined with percutaneous radiofrequency ablation (RFA) with a cooled RFA probe (Integra Radionics, Inc., Burlington, MA USA) of a lesion located in segments 5 and 6 of right lobe. After three months, a new lesion sized 15 mm occurred in the caudate lobe. The attempt of selective catheterization failed for the small size of feeding vessel.
The location of the lesion precluded percutaneous treatment. The site of the lesion along with the portal hypertension led us to prospect to an EUS-guide Nd:YAG LA. The patient was informed of the possibility of doing an EUS-guide Nd:YAG LA, and that, to the best of our knowledge, no case

of this procedure in the liver had been reported. The patient accepted the potential risks associated with the procedure and gave his informed consent.

Laboratory findings on admission revealed: white blood cell count 2.49 × 10^3/uL, platelet count 48 × 10^3/uL, alkaline phosphatase 135 U/L, g-glutamyltranspeptidase 159 U/L.

EUS was performed using a Pentax EG-3830 UTK linear echoendoscope (Pentax Europe GmbH, Hamburg, Germany) and a Hitachi Fulcro US processor (Hitachi Medical Corp., Tokyo, Japan) using 5-MHz, 7.5-MHz, and 10-MHz frequencies, under platelet transfusion and deep sedation. We proceeded to trans-gastric EUS-puncture of the lesion using a 22-gauge needle (Echotip 1-22; Wilson Cook Medical Inc., Winston-Salem, North Carolina, USA) following the application of Doppler in order to avoid the interposed vessels. Once the 22 G needle was pushed into the target and withdrawn for a few millimeters, needle stylet was removed to provide direct contact with the tissue of a quartz optical fiber with a tip 300 μm in diameter (Echolaser X4, Elesta S.r.l., Florence, Italy). A Nd:YAG laser with a wavelength of 1.064 nm (Echolaser X4, Elesta s.r.l., Florence, Italy) was used.

Briefly as previously described the treatment was planned taking into account the baseline volume of the lesions at EUS and the volume of necrosis that could be achieved in relation to energy delivered (Energy-related Necrosis).

The treatment started with the needles placed in the deepest part of the tumor. After the laser had been activated and the scheduled energy delivered, the needles were withdrawn approximately 5 mm within the lesion, and another laser illumination was performed. Each laser illumination was considered a single treatment. Up to six treatments were performed during session. To encompass the entire tumor, we performed multiple four-needle insertions and moved from one area to the next contiguous area. For each illumination, the laser was turned on at a power of 5.0 W, with an exposure time of 360 seconds that was adjusted to reach 1,200 J per fiber. Thus, the total energy delivered was 7,200 J.

Results.

After the procedure, patients were observed for 48 hours in the ward. Liver function tests and complete blood counts didn't increase at 12 and 24 hours. No major post-procedure complications were recorded according to the reporting standards of the Society of Interventional Radiology, and patient didn't report pain or abdominal discomfort or fever after treatment. Patients was discharged two days after the procedure.

Application of Nd:YAG LA did not have a negative effect on the quality of the EUS images during the treatment. At the end of treatment, the whole treated area was occupied by an irregular and poorly defined echogenic zone.

CT was performed at 24-hours after procedure with a helical scanner (Siemens Somatom Sensation Plus 64 CT scanner, Siemens AG Healthcare Sector Henkestrasse 127 D-91052 Erlangen. Germany). On precontrast CT scans, the whole treated area was replaced by an homogeneous, hypoattenuating, nonenhancing areas, which indicated avascularity and that corresponded with Nd:YAG LA-induced necrotic tissue

Discussion.

A potential advantage of Nd:YAG LA versus laser induced thermotherapy may result from the use of thinner needles, which is less traumatic for the liver of cirrhotic patients who have reduced coagulation function. Another advantage of Nd:YAG is a shorter time of application to obtain a lesion if compared to radiofrequency ablation. Moreover, the ability to be reused and re-sharpened and the ability to be used at different angles are some advantages of Nd:YAG LA among ablative liver therapies. LA treatment seems to be extremely well tolerated and produces no severe side effects or major complications. The wavelength and power of the Nd:YAG laser with tissue scatter and absorption creating heat produces an ablation zone of approximately 1–1.5 cm, allowing multiple percutaneous punctures to reach a tumor ablation zone of approximately 4 cm in the liver. Lesions adjacent to major vessels, biliary ducts, bowel or diaphragm can be treated with caution.

Conclusions.

The promising results in this single case need to be confirmed in additional patients in which lesions are difficult to reach by conventional methods.