Balloon-occluded percutaneous radio-frequency thermal ablation (RFA) as bridge to arterial chemoembolization (TACE) for management of advanced hepatocellular carcinoma with hepatic arteriovenous fistula: a technical innovation

Poster No.: C-1720
Congress: ECR 2012
Type: Scientific Paper
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Keywords: Oncology, Interventional non-vascular, Catheter arteriography, Ablation procedures, Chemoembolisation, Fistula
DOI: 10.1594/ecr2012/C-1720

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Purpose

Transcatheter arterial chemoembolization (TACE) is the most widely used palliative treatment for unresectable HCC and its efficacy has been demonstrated [1]. A main contraindication to TACE treatment is represented by arteriportal shunts (AP-S), which are uncommon in the liver but may occur, tipically related with HCC. Hepatic vein invasion by HCC allows AP-S to develop with increased risk of portal hypertension and liver dysfunction during chemoembolization [2,3]. Treatment options include arterial embolization of hepatic arteries with various materials such as gelatin sponges or coils with good short-term outcomes but poor long-term survival improvement [4,5]. Recently, chemoembolization during portal vein occlusion (TACE-PVO) has been experienced as an alternative treatment with good results in terms of tumor response and patient survival, but standardized treatment for HCC complicated by AP-S is still to be established [6].

Our aim was to evaluate safety and efficacy of balloon-occluded RFA (BO-RFA) in the temporary resolution of massive AP-S in patients with advanced HCC as bridge to a safe and effective TACE.
Methods and Materials

A prospective single-center multidisciplinary pilot study was carried out to evaluate the feasibility and safety of BO-RFA as bridge to as safe and effective TACE in patients with HCC complicated by AP-S.

Requirements for inclusion in our pilot study were: (a) multinodular unilobar unresectable HCC with a maximum target lesion diameter larger than 5 cm, not suitable to TACE alone due to the presence of a massive AP-S, (b) liver cirrhosis classified as Child-Pugh class A or B, (c) no extrahepatic metastases.

Between July 2010 and Nov 2011 5 patients (mean age 70±7; range 62-79; 3M, 2F) were enrolled in our study. Diagnosis of HCC was made on the basis of a positive serum #-fetoprotein level (>20ng/mL) or at least two imaging techniques showing characteristic findings of arterial hypervascularization.

A multiphase pre-treatment 64-multidetector-row CT scan (contrast flow rate 4 mL/s; unenhanced arterial, portal and late phases; slice thickness 0.625 mm) showed multinodular (2-6 nodules) unilobar unresectable HCC with a target lesion main diameter of 8.23±1.87 cm (range: 5.5-12 cm) with a concomitant massive AP-S (Fig. 1 on page 6).

Procedure was performed in an angiographic suite which had the structural characteristics of an opening room, using patient monitoring and anesthesiologic assistance.

Diagnostic angiography was performed under local anesthesia (10mL of 1% lidocaine) through a right common femoral approach, by placing a 6-Fr angiographic introducer. The selective celiac catheterism was performed with a 6Fr-guiding catheter (C1 or C2 curve, 65cm in length). A 0.014-inch guide wire was advanced into the segmental hepatic artery that was feeding the AP-S, enabling an optimal guidance of the low-profile monorail PTA-balloon. RFA was then performed under US-guidance with the patient under sedation and local anesthesia in the area where the electrode was placed. Fentanyl citrate was used for analgesia; lidocaine was used for local anesthesia. An internally cooled electrode with 3-cm exposed tip was then introduced into the the hepatic area surrounding the AP-S and the occlusion balloon in the hepatic artery was filled with a mixture of saline solution and contrast material.

The RF generator was activated, and the power needed to maintain a temperature of 90°C-115°C at the hook tips was delivered for 12 minutes. At the end of the procedure, the electrode was withdrawn and the occlusion balloon was deflated.

DSA was then performed to evaluate the presence of AP-S. Technical success of the procedure was defined by disappearance, reduction or persistence of the shunt. In case
of complete disappearance, a superselective chemoembolization of the main lesion was performed using a coaxial technique and placing a 2.7-Fr microcatheter in the distal segmental hepatic artery that was feeding the HCC.

An emulsion of carboplatin (Carboplatin) and iodized oil was infused, followed by embolization performed with gelatin sponge particles. A total of 450mg of Carboplatin was infused (Fig. 2 on page 6). Adverse events, intra and periprocedural complications were assessed. Alfa-fetoprotein and multiphasic spiral CT studies (64-row CT; contrast flow rate 4 mL/s; unenhanced, arterial, portal and late phases; slice thickness 0.625 mm) were performed one month after the procedure to evaluate responses to combined therapy according to m-Recist criteria.
**Fig. 1**: S.C. (M, 78 yo, HCV related cirrhosis, Child-Pugh B7, MELD 13, Esophageal Varices (F1), #-FP 52 ng/ml, AST 46 U/l; ALT 47 U/l) affected by residual large HCC (a, b, c) involving S8, S7, S6 previously treated with PEI and complicated by AP-S in S5 (d, e, f).

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**Fig. 2:** Percutaneous RFA of the hepatic area surrounding the AP-S during occlusion of the feeder artery (a), with no evidence of AP-S at the end of the ablation (b), allowing to perform a safe and effective chemoembolization (emulsion of Carboplatin 450 mg, iodized oil and Gelatin sponge particles) (c).

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Results

No major complications occurred. Technical success, defined as complete disappearance of fistula at pre-TACE angiography, was achieved in all patients, being able to undergo TACE. On 1-month CT exams, a mean necrotic diameter of 6.5±1.2 cm (range: 4-8.5 cm) was obtained with an acceptable lipiodol accumulation (>50%) and still persistence of the massive AP-S. Based on m-RECIST criteria, a partial response was achieved for all patients (persistence of vital tissue less than 30%) (Fig. 3 on page 9).
Fig. 3: Comparison between pre-treatment (a, c, e) and 1-month follow-up (b, d, f) CT-scan shows good response (partial response on the base of m-RECIST Criteria) with still persistence of AP-S.

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Conclusion

TACE is a well-known therapy for treatment of HCC and its efficacy has been largely demonstrated [1]. Main treatment complications are represented by liver dysfunction and portal hypertension and their occurrence have been associated with presence of AP-S [2,3]. Shunts may interfere with embolization procedure allowing an alternative via for embolizing materials which may pass through the fistula and could damage unaffected liver parenchyma. So AP-S have been traditionally considered a main contraindication to TACE treatment alone and patients have been usually addressed to additional therapies in order to reduce shunts prior to embolization. Traditional treatments are represented by arterial embolization of fistula with various materials (gelatin sponges or coils) with good short-term results but poor long-term outcomes [4,5].

We propose an innovative treatment, BO-RFA followed by TACE, for large HCC lesion complicated by massive AP-S. In our experience, BO-RFA allowed to temporary reduce shunting in all patients (technical success: 100%), producing a large perilesional hyperaemia area which diverted hepatic blood flow from fistula, with its complete disappearance. The temporary resolution of AP-S allowed to perform a safe and therapeutically useful TACE (5/5 partial response based on m-RECIST criteria), with still persistence of AP-S.

In conclusion, our results seem to demonstrate that BO-RFA could be used as bridge to a safe and effective TACE for management of advanced hepatocellular carcinoma with AP-S.
References


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