Transcatheter arterial chemoembolization of the extrahepatic collateral arteries in patients with hepatocellular carcinoma

Poster No.: C-1945
Congress: ECR 2010
Type: Scientific Exhibit
Topic: Interventional Radiology
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Keywords: Hepatocellular carcinoma, Transcatheter arterial chemoembolization, Extrahepatic collateral supply
DOI: 10.1594/ecr2010/C-1945

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Purpose

Transcatheter arterial chemoembolization (TACE) has become a widely accepted treatment procedure for hepatocellular carcinoma (HCC), and resulted in improvement of patients’ prognosis [1].

The rationale of HCC chemoembolization is based on the fact that the normal liver parenchyma has a dual blood supply from the hepatic artery and the portal vein, but in general HCC is exclusively supplied by the hepatic artery.

It is not uncommon to encounter HCC supplied also by extrahepatic collateral arteries, even when the hepatic artery is patent [2].

The development of collateral supply to HCC may represent one of the reasons for a partial or absent tumor response after TACE [2,3].

Initially described by Soo et al. in 1983 [4], chemoembolization through extrahepatic collaterals has been proposed as a therapeutic option in the management of HCC [5-7].

The purpose of this study is to evaluate the feasibility, safety and tumor response of TACE performed through collateral arteries in patients with HCC.

Methods and Materials

From February 2007 to August 2009, 24 patients (20 men, and 4 women; age range 50-84 years, mean 68.4 years) with HCC underwent a total of 26 TACE procedures of the extrahepatic collateral arteries.

Twenty one patients had undergone prior TACE sessions (range, 1-5 sessions) through the hepatic artery; in 11 cases TACE was performed by drug-eluting microspheres. Moreover, 3 patients had undergone left hepatectomy, 2 percutaneous ethanol injection (PEI) and 3 radio-frequency thermal ablation (RF).

TACE was performed by superselective catheterization of the arteries feeding the lesions; an emulsion of iodized oil and epirubicin hydrochloride was injected, followed by selective arterial embolization using gelatine sponge particles in 23 cases. The amount of administered iodized oil (3-20 mL) and anticancer drug (8-50 mg) was decided on the basis of number, location and diameter of the lesions.
For pain relief, intraarterial injection of 2% lidocaine (1-3 mL) was performed in specific cases.

We defined technical success the successful catheterization of the tumor feeding branch of the extrahepatic collaterals and the completion of the TACE procedure.

CT follow-up was performed one month after TACE.

Tumour response to TACE was evaluated according to the amendments to the RECIST criteria proposed by the European Association for the Study of the Liver (EASL) [8,9] and by the American Association for the Study of Liver Diseases (AASLD) [10]; complete response (CR) is the disappearance of any intratumoral arterial enhancement in all target lesions; partial response (PR) is at least a 30% decrease in the sum of diameters of viable portion (contrast enhancement in the arterial phase) of the target lesions, taking as reference the baseline sum of the diameters of target lesions; progressive disease (PD) is an increase of at least 20% in the sum of the diameters of viable (enhancing) target lesions, taking as reference the smallest sum of the diameters of viable (enhancing) target lesions recorded since the treatment started; stable disease (SD) is any case that do not qualify for either partial response or progressive disease.

**Results**

On digital subtraction angiography (DSA) the following extrahepatic collaterals feeding HCC were demonstrated: 25 right inferior phrenic arteries (Figs. 1,2), 2 right adrenal arteries, 1 right renal capsular artery and 2 branches from right renal artery. A single extrahepatic collateral was revealed in 22 TACE procedures and two collaterals in 4 procedures.

Tumors were located in segment VII (n=15), VIII (n=5), VI (n=4) and IV (n=2).

On CT scans, all tumors had a subcapsular location and their size ranged from 1 to 15 cm (mean 4.2 cm).

DSA demonstrated alterations of the hepatic arteries in 7/24 patients (29.2%). One patient showed a severe stenosis of the celiac trunk, another an occlusion on the proper hepatic artery and the remaining showed stenosis or occlusion of the right hepatic artery. In the latter case, the patients were previously treated by TACE of the hepatic arteries with a mean of 3 TACE sessions/patient.
TACE was successful in all cases, with no major immediate complications.

At 1-month CT, in 9 patients (37.5%) we observed asymptomatic pulmonary complications such as iodized oil accumulation in the lung fields (n=2) (Fig. 3), consolidation (n=4), pleural effusion (n=4) and diaphragmatic superelevation with pulmonary atelectasis (n=2) [11].

At 1 month CT follow-up, complete and partial response rates were 50% and 46%, respectively (Figs. 4-8), with only 1 case (4%) of stable disease.
Fig. 1: Selective angiography of the inferior phrenic artery (IPA) shows hypervascular tumor staining with right IPA supply.
**Fig. 2:** Same patient as figure 1. Selective angiography of the inferior phrenic artery (IPA) shows hypervascular tumor staining with right IPA supply.
Fig. 3: Iodized oil accumulation in the right lung field.
Fig. 4: Dynamic MRI, after i.v. injection of Gadolinium, shows arterial enhancement of a nodular lesion in the liver segment VII.
**Fig. 5:** Same patient as Figure 4. Dynamic MRI, after i.v. injection of Gadolinium, shows venous washout of a nodular lesion in the liver segment VII.
Fig. 6: Same patient as Figure 4. The HCC is supplied by the right adrenal artery.
**Fig. 7:** Same patient as Figure 4. At the end of the TACE treatment there is a complete deposition of iodized oil within the tumor.
Fig. 8: Same patient as Figure 4. Follow-up CT at 1 month reveals a complete response.
Conclusion

TACE of the extrahepatic collateral arteries is feasible and safe, with high objective response at 1 month follow-up.

References


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