

# Segmental transcatheter arterial embolization for primary hepatocellular carcinoma \*

LI Li, WU Pei-Hong, LI Jin-Qing, ZHANG Wei-Zhang, LIN Hao-Gao and ZHANG Ya-Qi

**Subject headings** liver neoplasms/therapy; carcinoma, hepatocellular/therapy; embolization, therapeutic; portal veins

## Abstract

**AIM** To evaluate the therapeutic effects of segmental transcatheter arterial embolization for primary hepatocellular carcinoma, and to recognize the manifestation and clinical value of lipiodol overflow into portal veins surrounding the tumors.

**METHODS** A total of 50 cases of nonresectable primary hepatocellular carcinoma underwent segmental transcatheter arterial embolization. Two methods of superselective segmental catheterization were used, one was the method of wire-guiding, and the other the technic of co-axial infusion catheter.

**RESULTS** The 1-, 2-, 3- and 4-year cumulative survival rates of 50 cases with segmental transcatheter arterial embolization for primary hepatocellular carcinoma were 83.8%, 65.4%, 42.9% and 24.5% respectively. The incidence of the lipiodol overflow into portal veins was 64%. The overflow of lipiodol into portal veins, represented as 3-5 grade branches of portal veins visualized by lipiodol, was "star-like" or "tree-like", and there was a relatively large vessel in the center surrounded with radicalized small branches of vessels.

**CONCLUSION** The lipiodol overflow into portal veins was one of the signs of complete embolization for tumors, and may play a partial role in embolizing the portal venous supply for hepatocellular carcinoma.

## INTRODUCTION

Segmental transcatheter arterial embolization (SLp-TAE) has become one of excellent interventional methods for primary hepatocellular carcinoma<sup>[1]</sup>. It was reported that SLp-TAE may play a dual role in embolizing the hepatic arterial and partly portal venous supply for hepatocellular carcinoma. We have performed SLp-TAE since 1990 in our hospital and accumulated some experience and reported it below.

## MATERIALS AND METHODS

### Materials

A total of 50 patients (48 men, 2 women) with nonresectable HCC undergoing SegLp-TAE were studied. They ranged in age from 23 to 71 years (mean, 41.8 years  $\pm$  4.2 years). The clinical symptoms included pain in upper abdomen, abdominal mass and weight loss. AFP was elevated in 44 patients, and cirrhosis occurred in 35 cases. Child's classification showed 15 cases of Child's A, 33 cases of Child's B, and 2 of Child's C. The main tumor measured 1.5 cm - 10 cm with a mean of 6.0cm $\pm$ 1.4cm (7 cases, >10 cm; 28 cases, 5 cm - 10 cm; and 15 cases <5cm). Multiple nodules were found in 10 of the cases.

### Methods

Coaxial infusion catheters of 3.0F with 0.013 inch micro-wire (Target Therapeutic Inc.) were used.

The feeding segmental or sub-segmental artery was detected carefully by celiac arteriography, and variants were excluded by superior mesenteric arteriography and phrenic arteriography. Two methods of superselective segment arterial catheterization were employed: one was wire-guiding catheterization, the other was technic of co-axial infusion catheter.

The volume of 2 ml - 20 ml emulsion (AOE, Adriamycin mixed with lipiodol) were injected, and Gelatin sponge particles were used in some patients. Before embolization, 2 ml - 3 ml of 1% lidocaine was injected to prevent vessel spasm.

## RESULTS

A total of 80 TAE (mean 1.6) were performed by two methods of segmental catheterization (34 by wire-guiding, 16 by co-axial catheter) with 16 cases of sub-segment, and 34 cases of segment in embolization position. Survival period ranged from 3 to 68 months (mean, 1.9 years  $\pm$  1.2 years). The 1-, 2-, 3- and 4-year cumulative survival rates were

Tumor Hospital, Sun Yat-Sen University of Medical Sciences, Guangzhou 510060, Guangdong Province, China

Dr. LI Li, male, born on 1968-10-08 in Changsha City, Hunan Province, Han nationality, graduated from Sun Yat-Sen University of Medical Sciences as a postgraduate in 1996, attending doctor of medical imaging, majoring oncological imaging diagnosis and interventional radiology, having 4 papers published.

\*Supported by "9.5" National Major Project of National Committee of Sciences and Technology, No.96-907-03-02.

**Correspondence to:** Dr. LI Li, Department of Imaging and Interventional Radiology, Tumor Hospital, Sun Yat-Sen University of Medical Sciences, 651 Dongfeng Road E, Guangzhou 510060, Guangdong Province, China

Tel. +86-20-87765368 ext 3216, Fax. +86-20-87754506

Received 1998-05-10

83.8%, 65.4%, 42.9% and 24.5% respectively. Complete necrosis was revealed in 3 resected lesions.

## DISCUSSION

It is well known that the blood supply of primary hepatocellular carcinoma is mainly from the hepatic artery, but the portal venous supply is important to its growth, especially, in the edge of tumor. Nakamura<sup>[2]</sup> introduced the segmental transcatheter arterial embolization which may play a dual role in embolizing the hepatic arterial and partly portal venous blood supply for hepatocellular carcinoma, leading to complete necrosis of tumor. The 1- and 2-year survival rates of 50 cases were 83.8% and 62.7% in his reports. In our study, the 1-, 2-, 3- and 4-year cumulative survival rates were 83.8%, 65.4%, 42.9% and 24.5%. The therapeutic results were comparatively good.

Two methods of superselective segmental arterial catheterization were used in our study, one was the wire-guiding catheterization, the other was the technic of co-axial infusion catheter. The successful rate of the former method was 60%-65%. The co-axial catheter was soft, adapted well to the distorted arteries, and could be easily inserted to the segment and sub-segment artery which supplied the tumor. But it is relatively difficult in operation, and need more time of exposure. In our study, we usually inserted the catheter in to proper hepatic artery or lobar artery by the wire-guiding method, before completing the segmental catheterization by the co-axial infusion catheter. The total success rate of segment catheterization was 80%-85%.

In 1988, Nakamura<sup>[1]</sup> discovered in plain abdominal radiograph immediately after injection of oil emulsion, that part iodized oil would overflow into portal veins surrounding the tumors through arteriportal shunt or communications when a relatively large amount of lipiodol was injected into the hepatic artery. In their cases, there was no arteriportal shunt in hepatic angiography. This phenomenon was confirmed by the animal experiment<sup>[3,4]</sup>. The occurrence rate of lipiodol overflow into portal veins was 64% (32/50 cases) in this series. It represented 3-5 grade branches of portal veins visualized by lipiodol which were “star-like” and “tree-like”, or a relatively large vessel in the center surrounded with small radiate branches.

Some authors<sup>[5,6]</sup> found in the resected specimen which demonstrated lipiodol overflow into portal veins, that not only complete necrosis of the tumors was achieved, but also partial necrosis or atrophy occurred in the normal tissues near the tumor. It was suggested that overflow of lipiodol into portal veins was one of the marks of complete embolization for tumors, and may play a partial role in embolizing the portal venous supply for the hepatocellular carcinoma.

There were eighteen cases without lipiodol

overflow into portal veins in our group, which was probably related to different blood supply for the neoplasm. The more affluence of blood supply, the more opportunity of lipiodol overflow. In our group, 71.9% of the cases demonstrated complete deposit of lipiodol in plain radiograph or CT, and only 2 cases with scarce deposit, which suggested that the more complete deposit of lipiodol, the more opportunity of lipiodol overflow through the arteriportal shunt inside the tumor. Additionally, in our practice the treatment was interrupted sometimes by obvious pain resulting from vessel spasm after a bit lipiodol injection, which probably influenced the occurrence of lipiodol overflow into portal veins.

Because primary hepatocellular carcinoma usually has the property of multi-center origin, and micro-tumor metastasis to small branches of portal veins, there were multiple foci beyond the tumor-bearing segment at early stage, which may not be detected by conventional CT or angiography. “Two-steps” method of transcatheter arterial embolization was adopted in some cases in which multiple foci may occur. First, segmental embolization was introduced to the main tumor-bearing segment or sub-segment. Secondly, in patient's tolerance, small dose of lipiodol was injected into the whole liver through the proper hepatic artery, so as not to leave out the micro-foci which escape detection before embolization.

**CONCLUSION** Segmental transcatheter arterial embolization has become one of excellent treatments of primary hepatocellular carcinoma<sup>[8,9]</sup>. The 1-, 2-, 3- and 4-year cumulative survival rates were 83.8%, 65.4%, 42.9% and 24.5% in our group. The long-term prognosis awaits further observations.

## REFERENCES

- 1 Nakamura H, Hashimoto T, Oi H, Sawada S. Iodized oil in the portal vein after arterial embolization. *Radiology*, 1988;167(2):415-417
- 2 Nakamura H, Oi H, Hori S, Takayasa Y, Furui S, Sawada S et al. Outcome of localized hepatocellular carcinoma treated with segmental arteriportal chemoembolization. *Cancer Chemoth Pharmacol*, 1992;31(Suppl 1):S69-S71
- 3 Kan Z, Ivancer K, Hagerstrand I, Chuang VP, Lunderquist A. *In vivo* microscopy of the liver after injection of lipiodol into the hepatic portal vein in the rat. *Acta Radiol*, 1989;30(4):419-425
- 4 Kan Z. Iodized oil injected in the hepatic artery will enter the portal vein [letter; comment]. *J Vasc Interv Radiol*, 1994;5(3):525-526
- 5 Matsuo N, Uchida H, Nishimine K, Soda S, Oshima M, Nakana H et al. Segmental transcatheter hepatic artery chemoembolization with iodized oil from hepatocellular carcinoma: antitumor effect and influence on normal tissue. *J Vasc Interv Radiol*, 1993;4(4):2543-2549
- 6 Khan KN, Nakata K, Kusumoto Y, Shima M, Ishii N, Koji T et al. Evaluation of nontumorous tissue damage by transcatheter arterial embolization for hepatocellular carcinoma. *Cancer Res*, 1991;51(20):5667-5671
- 7 Matsuo N, Uchida H, Sakaguchi H, Nishimine K, Hirohashi S, Ohishi H. Optimal lipiodol volume intracatheter arterial chemoembolization for hepatocellular carcinoma: study base on lipiodol accumulation patterns and histopathologic findings. *Semin Oncol*, 1997;24(Suppl 6):S60-71
- 8 Matsui O, Kadoya M, Yoshikawa J, Gabata T, Takashima T, Demachi H. Segment transcatheter arterial embolization for hepatocellular carcinoma: local therapeutic effect and 5-year survival rate. *Cancer Pharmacol*, 1994;33(Suppl):S84-88
- 9 Nishimine K, Uchida H, Matsuo N, Sakaguchi H, Hirohashi S, Nishimura Y et al. Segmental transarterial chemoembolization with lipiodol mixed with anti-cancer drugs for nonresectable hepatocellular carcinoma: follow-up CT and therapeutic results. *Cancer Chemother Pharmacol*, 1994;33(Suppl):S60-68