An Ischemic Skin Lesion after Chemoembolization of the Right Internal Mammary Artery in a Patient with Hepatocellular Carcinoma

Jae-Hoon Lee¹, Chae Yoon Chon¹, Sang Hoon Ahn¹, Byung Soo Moon¹, Jae Hak Kim¹, Yong-Han Paik¹, Kwang-Hyub Han¹, Jong Tae Lee², Do Yun Lee², and Young Myoung Moon¹

Departments of ¹Internal Medicine, Institute of Gastroenterology and ²Diagnostic Radiology, Yonsei University College of Medicine, Seoul, Korea.

A huge nodular hepatocellular carcinoma located at the anterior superior portion of the left lobe in a patient with hepatocellular carcinoma was treated with transcatheter arterial chemoembolization through the left hepatic artery. Three months later, however, there was a re-elevation of the serum alpha-fetoprotein level and evidence of a marginal recurrence at the left side of the previously embolized tumor was noted on the postembolization computed tomographic scan. Although the hepatic artery was intact in the second hepatic arteriography, we found that the right internal mammary artery was feeding the recurrent hepatocellular carcinoma. This internal mammary artery was successfully treated with Lipiodol-transcatheter arterial chemoembolization. However, an ischemic lesion occurred in the skin of the anterior chest and abdominal wall several days after internal mammary artery embolization. We report here a very rare case of ischemic skin lesion on the anterior chest and abdominal wall following transcatheter arterial chemoembolization of the right internal mammary artery. This internal mammary artery was embolized because it had developed a collateral tumor feeding vessel following the initial chemoembolization of a hepatocellular carcinoma.

Key Words: Hepatocellular carcinoma, internal mammary artery, transcatheter arterial chemoembolization, collateral, complication

INTRODUCTION

It is well known that hepatocellular carcinoma (HCC) normally receives its blood supply primarily from the hepatic artery.¹ Transcatheter arterial chemoembolization (TACE) is widely accepted as an alternative to surgical resection in the management of HCC. However, various extrahepatic collateral pathways to hepatic tumors may develop after interruption of the hepatic artery by surgical ligation, embolization or other causes.² The internal mammary artery (IMA) has been described as one of these potential hepatic collaterals.²,³ Reccurent HCCs supplied from the IMA after TACE have been described only in a limited number of cases reported in the literature.⁴–⁶ Furthermore, a case with ischemic skin lesion after IMA chemoembolization, known as a potential and theoretical complication, is extremely rare.⁴–⁶

In this report, we present a case of ischemic lesion in the skin of the anterior chest and abdominal wall after TACE of the right IMA, a collateral pathway that subsequently developed after previous embolization of a HCC.

CASE REPORT

A 48-year-old woman, a chronic hepatitis B surface antigen carrier, was admitted with primary complaint of right upper abdominal pain. A previously discovered serum alpha-fetoprotein level of 24,800 ng/ml led to an abdominal CT scan which confirmed a 7 × 5 cm sized nodular mass at the anterior superior portion of the left lobe of the liver (Fig. 1). A dual-phase contrast enhanced CT of the liver revealed a hypervascular mass...
similar to a HCC. The functional status was assessed as Pugh-modified Child Class A.

A hepatic arteriography through the left hepatic artery showed a huge nodular hypervascular mass in the left hepatic lobe (Fig. 2). A TACE was performed through the selective catheterization of the left hepatic artery. The hepatic artery was infused with 50 mg of doxorubicin hydrochloride (ADR; Il-dong, Seoul, Korea) and 14 ml of iodized oil (Lipiodol; Andre Guerbet, Aulnay-sous-Bois, France), and then, embolized with gelatin sponge particles (Gelform; Spongostan Standard, Ferrosan, Denmark).

Upon follow-up after one month, the abdominal CT scan demonstrated good retention of the iodized oil in the tumor tissue (Fig. 3) and the serum alpha-fetoprotein level decreased to 7,080 ng/ml.

However, at a follow-up after three months, the CT scan showed a marginal recurrence of HCC without iodized oil retention in the left side of the previously embolized tumor (Fig. 4). At this time the serum alpha-fetoprotein level had again increased to 29,900 ng/ml.

Therefore, a second arteriography was performed which showed a $3 \times 4$ cm sized mass in the upper portion of the previously iodized tumor. This recurrent tumor was mainly fed by the right IMA (Fig. 5a). The right IMA branch feeding the tumor was superselectively cathe

![Image](image1.png)  
**Fig. 1.** Preangioigraphy CT scan shows a nodular hepatic mass (arrow, $7 \times 5$ cm sized) at the anterior superior portion of the left lobe of the liver.

![Image](image2.png)  
**Fig. 2.** A hepatic arteriogram through the left hepatic artery showed a huge nodular hypervascular mass (arrow) in the left hepatic lobe. TACE was done at the left hepatic artery.

![Image](image3.png)  
**Fig. 3.** Postembolization abdominal CT scan demonstrated good retention of the iodized oil in the tumor tissue.

![Image](image4.png)  
**Fig. 4.** CT scan three months after TACE of left hepatic artery shows marginal recurrent HCC (arrow) without iodized oil retention in the left side of the previously embolized tumor.
Ischemic Skin Change after TACE of IMA in HCC

Fig. 5. The right IMA angiograms. (A) Note tumor staining (arrow) in the left side of the previously embolized tumor that was supplied by the right IMA (arrow head). (B) Note the right IMA branch feeding the tumor was superselectively catheterized (arrow head) and tumor staining was seen (arrow). TACE was done at the right IMA.

Fig. 6. Photograph at four days after post-IMA TACE. Note the skin lesion that is a well demarcated large-sized erythema, located in the anterior chest and right upper abdominal area.

Fig. 7. Photograph at thirty-three days after post-IMA TACE. The skin lesion is reduced in size, but remains scarred and pigmented as compared to Fig. 6.

terized (Fig. 5b), and a TACE was performed with 25 mg of doxorubicin hydrochloride (ADR), 6 ml of iodized oil (Lipiodol) and gelatin sponge particles (Gelfoam).

Following TACE of the right IMA, the patient complained of severe burning pain and erythema on the skin of the anterior chest and abdominal wall, as well as the usual postembolization symptoms of nausea, abdominal pain, and mild fever. Physical examinations revealed an acute ischemic change of the skin lesion including tenderness, heat sensation and a large sized erythematous skin change that was noted from the lower anterior chest wall to the right upper quadrant abdominal wall (Fig. 6).

Eight days following TACE, the patient was discharged from the hospital without any postembolization symptoms; nausea, abdominal pain or fever. However, for treatment the skin changes we recommended the patient undergo continuous
management of the skin lesion with local antibiotics and analgesic therapy. The skin lesion gradually improved.

Thirty-three days after TACE, there was no tenderness, redness or heat sensation, but only a scarred, pigmented and reduced size skin lesion on the right upper quadrant abdominal wall (Fig. 7). The patient recovered her normal activity. Unfortunately, at the one-month follow-up, a CT scan demonstrated incomplete HCC lipiodol uptake with a still-viable portion of tumor cells and additional lung metastasis.

DISCUSSION

TACE is widely employed as an alternative therapeutic approach to surgical resection and is an option for the major palliative treatment of patients with HCC. Pathology examinations of liver tissue following TACE have shown 90-95% tumor cell necrosis. Therefore, TACE is not a viable method to achieve complete remission, but can be used for tumor control. Repeated TACEs may be recommended when a local recurrence or new nodular lesions emerge. Ikeda et al. have described that the repetition of TACE was effective in prolonging survival.

However, repeated TACEs make it difficult to effectively manage the recurrence of HCC. As the number of TACEs increased, the development of extrahepatic collateral pathways to hepatic tumors also increased. Extrahepatic collateral pathways develop after interruption of the hepatic artery by surgical ligation, embolization or other causes. On the other hand, Kim et al. have reported that extrahepatic collaterals were frequently discovered, even when the hepatic artery was intact as in the case presented. In 1982, Chamsangavej et al. described that the primary sources of these extrahepatic collateral pathways were the pancreaticoduodenal arcade, periportal route, left gastric artery, inferior phrenic artery, paracolic gutter route and omental branches. TACE through these collaterals is a common-place procedure today and is successfully performed in most cases to effectively control recurrent HCC.

The IMA was described as a possible collateral pathway to the liver. The IMA arises in the proximal part of the subclavian artery distal to the origin of the vertebral artery and opposite or slightly proximal to the thyrocervical trunk. During its descent along the inner costal surface of the anterior chest wall near the sternal margin, the IMA gives off many branches to the anterior abdominal wall and diaphragm. It is divided distally into the musculophrenic artery and the superior epigastric artery that run through the falciform ligament and the ligamentum teres.

The IMA, as an extrahaepatic collateral pathway, is closely related to the location of the hepatic tumor. Macaulay et al. have described that primary or metastatic tumors located anterosuperiorly in the liver may recruit blood supply through the IMA collaterals. Additionally, other authors have reported cases of collateral IMA embolization, and have emphasized on the tumor location supplied by IMA, and which is usually located at the anterior and superior portion of the liver abutting the diaphragm and anterior abdominal wall, regardless of the patency of the hepatic artery. In the case presented here, we suspected the collaterals to the recurrent tumor due to a noticed re-elevation of serum alpha-fetoprotein despite adequate previous embolization. Further evidence of this was supported by a focal defect of iodized oil retention with a viable tumor seen on CT scan, and in particular, the correlation between the anatomic IMA distribution and the recurred lesion on the anterosuperior portion of the liver.

Only a few cases of collateral IMA embolization in HCC have been reported in the literature when compared with other more frequently occurring collaterals. Furthermore, most of these cases had no complications similar to skin lesions after IMA embolization with the exception of a case with ecchimosis on the right costal arc for three days. The most serious potential and theoretical complication of IMA embolization is precordial skin ulceration. These severe ischemic changes occurred in the skin of the anterior chest and abdominal wall after TACE of the IMA, probably due to insufficient distal catheterization of the artery or inadvertent regurgitation of embolizing material to other arteries.

However, proximal occlusion of IMA seldom leads to an ischemic change of the skin and soft
tissue because of the many anastomoses of the superior epigastric and musculophrenic arteries to the abdominal wall as well as the intercostal and perforating branches to the anterior chest wall.\textsuperscript{33,34} For this reason, the patient in our case did not suffer from irreversible ischemic change on the chest and abdominal wall, but rather developed an ischemic skin lesion which slowly improved day by day. To minimize the complications of collateral TACE, it is important to perform, as much as possible, a more selective distal catheterization.\textsuperscript{4,8}

In conclusion, this extremely rare case of ischemic skin change on the anterior chest and abdominal wall, following TACE of the right IMA, provides some valuable lessons in the treatment of hepatocellular carcinoma. When a collateral tumor feeding vessel from the IMA develops, after previous embolization of the main HCC tumor mass, it is of utmost importance to have a clear understanding of the anatomical distribution of the collateral feeding vessels. When there is evidence of recurrent HCC of the anterior superior portion of the liver, although rare, one must consider the possibility of an IMA collateral pathway. Furthermore, to avoid the severe complication of ischemic skin change, superselection catheterization should be achieved at the most distal target branch as possible.

Chae Yoon Chun, M.D.
Department of Internal Medicine, Yonsei University College of Medicine,
C.P.O. Box 8044, Seoul 120-752, Korea,
Tel: 82-2-361-5410, Fax: 82-2-393-6884,
E-mail: inga@yunc.yonsei.ac.kr

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