

INVESTIGATION OF BLOOD SUPPLY OF BRONCHOGENIC CARCINOMA DERIVING FROM PULMONARY ARTERY

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Microfil perfusion technique was used to investigate the blood supply of bronchogenic carcinoma deriving from pulmonary artery on 20 fresh specimens of lung cancer, including 11 squamous carcinoma, 6 adenocarcinoma, 1 alveolar cell carcinoma and 2 undifferentiated carcinoma cases. The results showed that the appearance and quantity of pulmonary blood supply of bronchogenic carcinoma depended on and changed with the site, activity, growth mode as well as the local condition of tumor nodules; pulmonary artery supplied blood to the periphery of the tumor and its innermost part as well; vessels from pulmonary artery in tumor nodules were generally less in number than those in the surrounding normal lung tissues around. The results suggested that the tumor blood supply from pulmonary artery should be evaluated comprehensively and dynamically; during interventional chemotherapy via pulmonary artery, patients should be selected carefully and the catheter for infusion placed in suitable position so as to gain the best therapeutic effect.

Key words: Lung, Neoplasms/Blood supply; Carcinoma, Squamous Cell/Blood Supply; Lung, Carcinoma/Blood Supply; Pulmonary Artery

In recent years, with the development of interventional therapy for bronchogenic carcinoma, the blood supply of the tumor has been attracting

more attention. For instance there is a controversy on whether the blood supply of bronchogenic carcinoma derives from the pulmonary artery.¹⁻⁴ Those who agree usually prove their viewpoint with barium sulfate perfusion,²⁻⁴ while those who disagree generally carry their study with Chinese-made silicone.⁴ Compared with barium sulfate perfusion, silicone perfusion technique is more superior in investigation of blood supply of tumor, particularly in double blood supply. We have investigated the blood supply in 20 fresh specimens of lung cancer by perfusing imported silicone (Microfil). Results of the research are reported here.

MATERIALS AND METHODS

Twenty fresh specimens were sampled randomly, which were resected during operations performed in the department of thoracic surgery of our hospital from Jan to Jun 1993. Among them 5 were the superior lobe of the right lung, 4 the inferior lobe of the right, 2 the middle and the inferior lobe of the right, 4 the superior lobe of the left, 3 the inferior lobe of the left, 1 the right total lung and 1 the left total lung. Lung carcinoma was confirmed with fiber-bronchoscopic biopsy pre-operatively in the patients. Postoperative pathology indicated 11 squamous carcinoma, 6 adenocarcinoma, 1 alveolar cell carcinoma and 2 undifferentiated carcinoma. Classified by X-ray films, there were 7 central type

carcinoma and 13 peripheral type.

The pulmonary arteries of all specimens were labeled during operation, the perfusion was made in two hours after excision. A 4-F catheter was inserted in the cavity of pulmonary artery, and then the incised edge ligatured. At first, normal saline was perfused to blanch the lung tissues supplied by pulmonary artery so as to change their color from bright red into light red. Then prepared Microfil (Flow Tek, Boulder Colo) and M122 (orange red) or M117 (yellow) were perfused slowly. In two of the patients the tumor affected arteries were perfused with two kinds of color of Microfil respectively (bronchial artery was perfused in 17 cases at the same time, reported in another thesis). Perfusion was stopped until silicone appeared like a thin net on the surface of lung. The specimens were treated with the method of Lin Gui, et al.⁵ First they were kept in a refrigerator at 4 °C over night. The next day they were cut to 1 cm thick sections, which were dehydrated by being soaked in 25%, 50%, 75%, 95% and 99% alcohol solution respectively for 2 days. Finally they were hyalinized in methyl salicylate solution. The hyalized specimens of tumor and its surrounding normal lung tissues were cut into 2-3 mm thick sections, of which the capillaries were photographed with an operating microscope in methyl salicylate solution. Then the tissues of the relevant part were stained with HE for pathological study. The presence and distribution of blood supply of bronchogenic carcinoma and the morphology of the blood vessels, etc. demonstrated by capillary photography, and the sizes and positions of the tumors were recorded and classified for assessment of blood supply of the carcinoma.

RESULTS

Of the 20 specimens, 16 had blood supply from pulmonary artery, 13 were lung carcinoma of peripheral type, 3 of central type. 4 cases had not pulmonary blood supply, and were all central type carcinoma, growing along the inside walls of the bronchus, and 2 of the 4 were complicated by atelectasis.

The investigation showed the following characteristics of pulmonary blood supply of lung cancer:

1. As the tumor was supplied by pulmonary arteries in peripheral type carcinoma, the arteries were

commonly interrupted by local suppression of the tumor leading to a lack of blood in some areas of the tumor. We could see blood supplied from pulmonary artery in both periphery and center of cancer, but compared with periphery blood was less in the center.

2. After the Microfil of two colors was perfused through different branches of pulmonary artery, it was distributed in relatively distinct regions of the tumor. Anastomosis was not obvious.

3. In the 3 central type carcinoma with pulmonary blood supply, the most part of the tumor grew out of the cavity, and all the cavities of the bronchus were unobstructed.

DISCUSSIONS

There has been dissidence as to whether pulmonary artery is involved in blood supply of pulmonary neoplasms.¹⁻⁴ However, unanimity has almost been reached in that there is blood supply from pulmonary artery in the periphery of peripheral type carcinoma of the lung.^{1,4} Most of the experimental results are not comparable because of the variety of the methods used. Those who agreed that there is pulmonary blood supply of bronchogenic carcinoma had applied barium sulfate for their perfusion, while those who were against the view had used silicone perfusion. So we made our investigation by means of imported silicone (Microfil). The results showed that blood supply from pulmonary artery was present in not only peripheral type but also central type carcinomas of lung, which supplied not only the periphery, but also its inner area. Based on our research, the existence of pulmonary blood supply of bronchogenic carcinoma depends on the site, the growing mode as well as the local condition of tumor nodules. It appears when most part of a central type carcinoma grew out of the cavity not complicated with obvious atelectasis, there may be blood supply from pulmonary artery. And also, the pulmonary artery could be seen extending into the inner part of the tumor when the tumor nodules grew luxuriantly without necrosis inside. When the tumor nodules enlarged to obstruct bronchial, cavity and necrosis and retrogression developed in their central part, the pulmonary blood supply reduced obviously and was even interrupted. This phenomenon has not been reported in the literature. Therefore, we suggest that the blood supply of pulmonary cancer from pulmonary artery be

evaluated from a comprehensive and dynamical point of view.

In pulmonary artery radiographs of lung carcinoma, the tumor occupied area usually appears to be a low density one with filling defect, for which some investigators denied the existence of pulmonary blood supply for lung cancer. Our investigation showed that vessels from pulmonary artery in tumor nodules were generally less than those in the surrounding normal lung tissues. That's why in the artery radiographic photographs the tumor did not show the sign of staining. This suggests that during interventional chemotherapy via pulmonary artery, the catheter for infusion should be placed in suitable position, otherwise a lot of chemotherapeutic agents would be infused to normal lung tissues resulting injury. Since the pulmonary blood supply of lung cancer is changing dynamically, interventional chemotherapy via pulmonary artery should follow an evaluation of the quantity of pulmonary blood supply for bronchogenic carcinoma according to its site, growing mode and local conditions. This evaluation should also be referred to for selection of patients and the process of the therapy.

Compared with other methods, perfusing capillaries with silicone is an ideal technique to

investigate blood supply of *vitro* specimens. The case number of our report is large, so the result is reliable. However, to evaluate interventional chemotherapy via pulmonary artery, more investigation is to be made in *in vivo* specimens.

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