Assessment of aortic invasion by pulmonary carcinoma with the use of intra-aortic endovascular sonography: A case report

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Although intra-aortic sonography has been used in the assessment of the thoracic aorta in various diseases,^{1,2} to our knowledge no case of advanced lung cancer necessitating intra-aortic sonography to assess aortic invasion has been reported.

Clinical Summary

A 48-year-old man was referred to our department for assessment of aortic invasion by pulmonary carcinoma. He had pulmonary carcinoma in the upper segment of the left upper lobe. Bronchoscopic biopsy from the left upper lobe bronchus revealed moderately differentiated adenocarcinoma. Computed tomographic (CT) scanning and magnetic resonance (MR) imaging strongly suggested aortic invasion of the tumor. However, we had encountered some cases of advanced esophageal carcinoma in which CT and MR imaging suggested invasion of the aorta, but intra-aortic sonography accurately disclosed that there was no aortic invasion. For that reason, we performed intra-aortic sonography in this patient to assess the degree of aortic invasion.

We performed thoracic aortography and thereafter inserted the 9F, 80-cm long introducer into the right femoral artery. Then, an intravascular echocardiogram catheter (9.5 MHz) (Ultra ICE; Boston Scientific, San Jose, Calif) was inserted into the thoracic aorta through the introducer. The catheter was withdrawn under fluoroscopic guidance while cross-sectional sonographic images of the area under investigation were printed and recorded on videotape for subsequent analysis.

CT scans were obtained with an Aquilion scanner (Toshiba Medical Systems, Tokyo, Japan) with interleaved multidetector capability (4 detectors) immediately after intravenous administration of 100 mL of iohexol 68% (Omnipaque; Daiichi Pharmaceutical, Tokyo, Japan) at a rate of 3 mL/s. Helical techniques with 3-mm collimation and a table speed of 16.5 mm/s were

applied. Axial images with 5-mm thickness were reconstructed at 5-mm intervals. MR images were obtained with a 1.5-T unit (Vision; Siemens Medical Systems, Erlangen, Germany) with the transverse T2-weighted turbo spin echo sequence followed by the transverse and coronal T1-weighted turbo spin echo sequences.

With intra-aortic endovascular sonography, the diagnostic criterion¹ for aortic invasion was obliteration of the outer hyperechoic layer of the aorta. To assess the aortic invasion on CT and MR imaging, we applied the following criteria^{3,4} to our patient. Contact between the pulmonary tumor and the aorta along at least an angle of 90° of the aortic circumference with loss of the intervening fat plane was considered positive for invasion; a contact of less than an angle of 90° indicated no invasion.

CT, MR imaging, and endovascular sonography were reviewed independently by 2 radiologists, each without knowledge of the other's examination or interpretation or the results of the operation. The tumor was diagnosed as positive for aortic invasion (T4) on CT and MR imaging (Figure 1). Intra-aortic sonography (Figure 2), however, revealed freedom from aortic extension (T3), because the outer hyperechoic layer of the aorta was intact.

Surgery was performed 10 days after intra-aortic sonography. The lung tumor was resectable and the frozen section proved it to be free from aortic invasion histopathologically.

Discussion

Koda and associates¹ reported 100% accuracy of the intra-aortic endovascular sonographic studies in the assessment of aortic invasion by esophageal carcinoma. Uflacker and coworkers² reported their experience with intravascular sonography for the diagnosis of traumatic rupture of the aorta. Transesophageal echography⁵ has been used in the clinical classification of gastrointestinal tumors and may be of help in the mediastinal evaluation of lung cancer as well. However, the use of intra-aortic sonography to assess aortic invasion by advanced pulmonary carcinoma has not been reported.

T4 tumors that invade structures in theory are not amenable to excision. Although gross mediastinal invasion with encasement of mediastinal structures can be confidently diagnosed with CT, contiguity of tumor with adjacent mediastinal structures is not equivalent to definite invasion. In addition, localized invasion is not necessarily a contraindication to surgical resection. For these reasons, an accurate diagnosis of aortic invasion is very important. Several authors³⁻⁵ have illustrated cases in which patients were thought to have unresectable masses on the basis of CT findings, and the masses were shown to be resectable at surgery. Drawing a distinction between T3 and T4 masses is very important for planning of therapies for the tumor. Furthermore, the previously reported criterion¹ for aortic invasion of esophageal cancer on the intra-aortic

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Figure 1. Coronal thoracic T1-weighted image is highly suggestive of aortic invasion by lung cancer of the left upper lobe.

sonogram could be applied even to the diagnosis of aortic invasion by lung cancer.

In conclusion, we found that intra-aortic endovascular sonography is very useful in assessing aortic invasion by pulmonary carcinoma.

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Figure 2. Intra-aortic sonography showing freedom from aortic extension of the lung cancer, because the outer hyperechoic layer of the aorta is intact (arrow).

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