



Preoperative evaluation of adrenal lesions based on imaging studies and laparoscopic adrenalectomy in patients with otherwise operable lung cancer

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KEYWORDS

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Summary

Purpose: An unsuspected adrenal mass (AM) could be discovered in patients with operable non-small-cell lung carcinoma (NSCLC), but it is difficult to determine the nature of AM. The purpose of the study is to answer the question as to which decision should be made when assessing AM in patients with NSCLC.

Patients and methods: From 1997 to 2005, 40 patients (31 male; mean age: 63 years) were identified to have both NSCLC and AM. We tried to determine the nature of AM based on imaging studies with or without laparoscopic adrenalectomy. When AM was considered benign on CT or PET-CT, surgical resection of NSCLC was performed (group 1, $n=25$). When AM was considered indeterminate on CT or PET-CT, we performed MRI to determine the operability. In eight patients, surgical resection of NSCLC was performed, because AM was considered benign on MRI (group 2). In seven patients, adrenalectomy was performed to confirm AM pathologically, because all imaging studies were indeterminate (group 3).

Results: Follow-up was complete for all patients with a mean duration of 33.1 months (3–104.5). In group 1, no patients showed adrenal metastases, except one who died of adrenal metastasis. In group 2, three patients revealed that they had had adrenal metastases when staging and two died of adrenal metastasis. In group 3, one patient had an adrenal metastasis and the others had benign lesions.

Conclusions: We suggest that when AM is considered benign on CT or PET-CT, surgical resection of NSCLC is indicated. However, when AM is indeterminate on CT or PET-CT, histopathologic confirmation is needed to determine the nature of AM.

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1. Introduction

An unsuspected adrenal mass (AM) could be encountered while staging patients with operable non-small-cell lung carcinoma (NSCLC). However, the presence of AM itself does not necessarily represent metastasis, because a considerable portion of the general population has been shown to harbor benign adenomas (2–9%) [1]. Considering that the prognosis as well as the treatment strategies apparently depend on whether the adrenal lesion is benign or malignant, it is of great importance to ascertain what the lesion really is. Nevertheless, it is difficult to determine the nature of AM because there have been no diagnostic tests that proved to be absolutely perfect. Although percutaneous biopsy is considered the gold standard for demonstrating the cause of AM, sampling error can occur and the procedure is an invasive technique often associated with complications. Accordingly, there has been a lot of debate over rational decision-making when AM is discovered during the staging workup.

In patients with both NSCLC and AM, we tried to determine the operability mainly based on the findings of imaging studies without the need of biopsy and then proceeded to perform surgical resection. When all imaging studies revealed uncertain results, laparoscopic adrenalectomy was performed to confirm AM. After potentially curative operations, we followed up their clinical courses and collected information on AM by performing follow-up imaging studies in this study cohort. The purpose of the study is to review the eventual outcomes of NSCLC and AM retrospectively and to answer the question as to which decision should be made when assessing AM in patients with NSCLC.

2. Patients and methods

2.1. Study population

Between March 1997 and July 2005, a total of 1738 patients with potentially operable NSCLC were referred to our institution to perform curative resection. All of them underwent preoperative evaluations, including computed tomography (CT) scanning of the chest and upper part of the abdomen. Since May 2003, integrated positron emission tomography (PET) with F-18 fluorodeoxyglucose (^{18}F -FDG)-CT (PET-CT) has been used in conjunction with conventional CT, as clinically indicated. In patients with adenocarcinoma, magnetic resonance imaging (MRI) of the brain was performed to rule out cerebral metastasis.

As a result, a total of 40 patients (2.3%) were found to have both the primary lung tumour and AM with no evidence of other distant metastatic diseases. Thirty-one patients were men and 9 were women (mean age: 63 years; range: 39–84 years). The histologic type of the primary lung tumour included adenocarcinoma in 22 patients and squamous cell carcinoma in 14. The clinical TNM classification of the primary tumour was stage I in 22 patients, stage II in 6, stage IIIA in 9, and stage IIIB in 3. All the patients underwent CT scanning, which suggested an adrenal metastasis in 10. PET-CT was performed in 16 patients, of whom 7 were suspected to have an adrenal metastasis with a mean FDG uptake of 7.0 ± 2.9 SUV (the standardized uptake value, range: 4.3–12.8 SUV). In two patients, adrenal metastases were

Table 1 Patients characteristics

Characteristic	All patients	Group 1	Group 2	Group 3
No.	40	25	8	7
Age	63 ± 9	63 ± 10	63 ± 7	60 ± 9
Sex				
Male/female	31/9	19/6	7/1	5/2
Histology				
ADC	22	15	3	4
SQC	14	8	3	3
Others	4	2	2	—
Clinical T stage				
T1	10	7	—	3
T2	25	16	5	4
T3	3	—	3	—
T4	2	2	—	—
Clinical N stage				
N0	28	18	5	5
N1	3	1	1	1
N2	9	6	2	1

ADC, adenocarcinoma; SQC, squamous cell carcinoma.

suspected on both CT and PET-CT. The size of AM ranged from 1.0 to 11.0 cm (mean: 2.2 ± 2.4 cm). The location of AM was ipsilateral to NSCLC in 19 patients, contralateral in 15, and bilateral in 6. The characteristics of the patients and AM are shown in [Tables 1 and 2](#).

2.2. CT, PET-CT, and MRI

With respect to CT, all patients underwent stand-alone chest CT (enhanced study with intravenous injection, 100 mL [Iopamidol, Iopamiron 300; Bracco, Milan, Italy]). With respect to PET-CT, patients received an intravenous injection of 370 MBq of ^{18}F -FDG and then rested for approximately 45 min before undergoing imaging. Image acquisition was performed using an integrated PET-CT device (Discovery LS, GE Healthcare, Milwaukee, WI) consisting of an Advance NXi PET scanner and an 8-slice Light Speed Plus CT scanner. CT was performed from the head to the pelvic floor using a standardized protocol involving 140 kV, 80 mAs, a tube-rotation time of 0.5 s per rotation, a pitch of 6, and a section thickness of 5.0 mm. Immediately after CT, PET was performed in an identical axial field of view. The acquisition time for PET was 5 min per table position. With respect to MRI, examinations were performed with either a 1.5 T system (Signa Horizon, GE Healthcare, Milwaukee, WI) and a torso phased-array coil or a 3 T system (Intera Achieva 3T, Philips Medical System, Best, the Netherlands) and a phased-array coil (Cardiac SENSE, Philips Medical System, Best, the Netherlands). All patients underwent transverse breath-hold gradient-echo T1-weighted in- and opposed-phased imaging.

2.3. Diagnostic algorithm

An adrenal mass was suspected to be benign (1) if the size of AM was 1 cm or less on CT or (2) if the lesion had homogeneous low attenuation on CT or (3) if the FDG uptake in

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