Lung Cancer 76 (2012) 56–60

Contents lists available at SciVerse ScienceDirect

Lung Cancer

journal homepage: www.elsevier.com/locate/lungcan

Ground-glass opacity lesions on computed tomography during postoperative surveillance for primary non-small cell lung cancer

Akira Haro, Tokujiro Yano*, Mikihiro Kohno, Tsukihisa Yoshida, Tatsuro Okamoto, Yoshihiko Maehara

Department of Surgery and Science, Graduate School of Medical Sciences, Kyushu University, Maidashi 3-1-1, Higashiku, Fukuoka 812-8581, Japan

ARTICLE INFO

Article history:
Received 17 May 2011
Received in revised form 12 August 2011
Accepted 4 September 2011

Keywords:
Adenocarcinoma
Bronchioloalveolar carcinoma
Ground-glass opacity
High-resolution computed tomography
Non-small cell lung cancer
Postoperative follow-up
Surgical resection

ABSTRACT

Improvement in chest high-resolution computed tomography (CT) has increased the detection of ground-glass opacity (GGO) lesions. However, there is no clear therapeutic consensus about concurrent GGO lesions detected during postoperative follow-up chest CT after treatment for primary lung cancer. This study retrospectively and prospectively investigated 21 patients in whom 53 GGO lesions were detected during postoperative follow-up CT of non-small cell lung cancer at Kyushu University Hospital from April 2009 to February 2010. We investigated clinicopathological factors, such as age, gender, lesion number, size, laterality, time of identification, and enlargement or emergence of the inner solid component. The malignancy rate of the concurrent GGO lesions was assessed by log-rank test in the Kaplan–Meier curves. Twenty percent of the 53 GGO lesions had malignant radiological findings during the 5-year follow-up after they were first identified by CT. The newly emerging GGO lesions at postoperative CT had significantly more malignant radiological findings (39.5%) than other GGO lesions (9.5%). Three potentially malignant GGO lesions were treated by surgical resection and three were treated by stereotactic radiotherapy. These six treated GGO lesions showed a good clinical course without recurrence after treatment. Special attention should be paid to newly emerging GGO lesions after resection of primary non-small cell lung cancer. It is necessary to select an appropriate treatment, taking account of various factors such as the laterality and number of GGO lesions or the pathological stage of the postoperative lung cancer.

1. Introduction

Ground-glass opacity (GGO) lesions have been detected by chest computed tomography (CT) since the 1990s [1,2], and the number is rapidly increasing with the improvement of chest high-resolution CT (HRCT) technology [3–8]. A GGO lesion is a non-specific finding defined as hazy, increased attenuation of lung structure on HRCT [9,10], and is a histological mixed category that includes both benign diseases, such as inflammation and fibrosis [11] and alveolar hemorrhage and malignant diseases, such as adenomatous atypical hyperplasia, bronchioloalveolar carcinoma (BAC) and adenocarcinoma [12–14]. Investigation of the natural history of GGO has gradually revealed that there are two subgroups: one needs treatment and the other may be observed for a long time. Furthermore, there is a close relationship between GGO and BAC [7,15], and thus it is necessary to make a diagnosis of the potentially malignant GGO lesion and start appropriate treatment as quickly as possible. Surgical resection is therefore considered to provide excellent control of GGO lesions [2,9,12].

Many GGO lesions are detected during follow-up CT after resection of primary lung cancer [2,16]. There is currently no consensus for the optimal management of concurrent GGO lesions identified during postoperative follow-up CT after resection of primary non-small cell cancer. Interestingly, a past history of primary lung cancer is a strong risk factor for GGO growth [2,16]. Therefore, close monitoring of the concurrent GGO lesions in clinical follow-up is necessary to check for malignant radiological findings, such as an increase in the size or the inner solid component of the GGOs, in addition to looking for primary lung cancer recurrence [2,17]. The current clinical management is generally determined by the radiological findings of GGO by CT without a definitive diagnosis, because the malignancy of GGO lesions is still unclear in positron emission tomography (PET) [18], and tumor dissemination can occur after CT-guided biopsy [19]. In addition, little is known about the proliferation rate or molecular mechanism of GGOs [17,20,21], and the enlargement velocity or density by chest CT cannot currently be predicted [18]. It is often difficult to decide whether to observe carefully or treat early small GGO lesions, taking account of the various factors and possibilities that recurrence of primary lung cancer or newly emerging GGO lesions may occur in the same patient in the future. The management of these lesions is now gradually being recognized as important. The question emerges: What type of therapy is best, and how long should such treatment be administered [2],

* Corresponding author. Tel.: +81 92 642 5462; fax: +81 92 642 5482.
E-mail address: tokujiro@surg2.med.kyushu-u.ac.jp (T. Yano).

0169-5002/$ – see front matter © 2011 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.lungcan.2011.09.002

Table 1
Characteristics of 55 GGO lesions.

Factor	Category	Number of GGOs (percentage)
Lesion number	Multiple/single	46 (86.8%)/7 (13.2%)
Average lesion size	<10 mm/≥10 mm	29 (54.7%)/24 (45.3%)
Laterality	Bilateral/lateral	24 (45.3%)/29 (54.7%)
Time of identification	Postoperative/ preoperative	17 (32.1%)/36 (67.9%)
Inner solid component	Present/absent	11 (20.8%)/42 (79.2%)

GGO: ground-glass opacity.

especially for patients with multiple GGO lesions or new emerging GGO lesions during postoperative follow-up CT after lung cancer resection?

This study investigated the clinical course of 53 concurrent GGO lesions identified during follow-up CT after resection of primary lung cancer. The results showed that emerging GGO lesions are a potentially malignant factor, and suggest an appropriate clinical management strategy for GGO lesions.

2. Patients and methods

2.1. Patients

This study retrospectively and prospectively investigated 21 patients in whom 53 GGO lesions were detected during follow-up CT after resection of non-small cell lung cancer. The follow-up CT was performed between April 2009 and February 2010.

The average age at the time of resection of the primary non-small lung cancer was 64.4 (57–80) years old (Table 1). Fifteen of the 21 patients were female (71.4%) and six were male (28.6%). The most common pathological stage of the primary non-small cell lung cancer was IA (12/21 cases) or IB (8/21 cases). The pathological stage of the last case was IIB (1/21).

2.2. GGO lesions on CT

The average number of GGO lesions in each patient was 2.5, and the average size of all 53 GGO lesions was 10.4 (2–31) mm. A total of 24 lesions (45.3%) occurred in both lungs, and 46 lesions (86.6%) were simultaneous multiple lesions. Seventeen of the 53 lesions (32.1%) were first identified by postoperative CT, while 36 (67.9%) had been identified by preoperative CT. A total of 11 lesions (20.8%) had inner solid components, while 42 (79.2%) did not.

2.3. Follow-up of GGO lesions

The first follow-up chest CT was usually performed at 6 or 12 months after lung cancer resection, and chest X-rays that were taken every 3 or 6 months and chest CT every 12 months were examined for signs of primary lung cancer recurrence or new malignant GGO lesions. Further chest CT was performed 2 or 3 months later if new GGO lesions emerged or if the size of an existing lesion increased. Treatment including surgical resection was initiated if the next follow-up CT indicated either growth or malignancy. Follow-up CT was done every 6 or 12 months thereafter if there was no change in the subsequent chest CT.

The follow-up time was from the initial detection to detection of the first malignant radiological change or until the final CT examination. The potential malignancy of the GGO lesions was evaluated during follow-up. The follow-up time for all of the GGO lesions from the first identification on chest CT was 10–170 months (median, 49 months).

2.4. Definitions of malignant findings

An increase in size, increase in density, or elongation or emergence of a solid component was defined as a malignant radiological finding (Fig. 1). The size was defined as the maximal diameter on HRCT, and an increase in diameter of >2 mm was defined as a malignant radiological finding. Radiologists and physicians performed careful and close monitoring to determine whether GGO lesions had any malignant radiological findings.

2.5. Treatment

The clinical management strategy was to resect the GGO lesion if it was resectable and on the opposite side from the previous

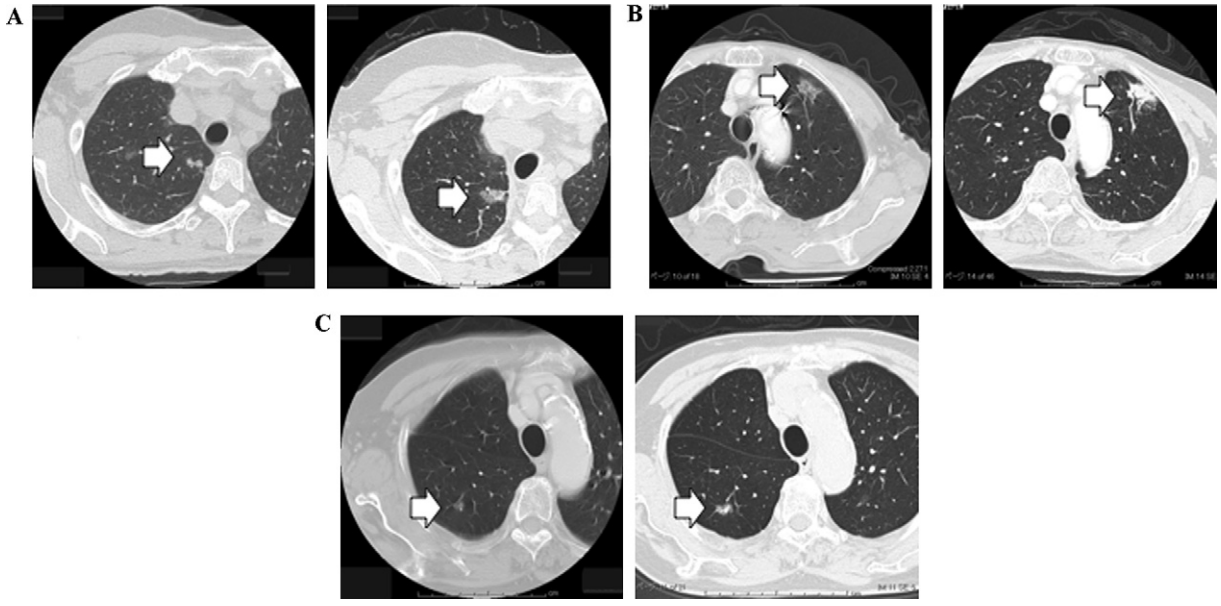

Fig. 1. Malignant radiological findings of GGOs. There was an increase in the size of GGO in case 3 (A), an increase in density in case 7 (B), and an increase in both size and density in case 4 (C).