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Potential contribution of multiplanar reconstruction (MPR) to computer-aided detection of lung nodules on MDCT

Sumiaki Matsumoto[a,*], Yoshiharu Ohno[a,1], Hitoshi Yamagata[b,2], Munenobu Nogami[a,c,1,3], Atsushi Kono[a,1], Kazuro Sugimura[a,1]

[a] Department of Radiology, Kobe University Graduate School of Medicine, 7-5-2 Kusunoki-cho, Chuo-ku, Kobe, Hyogo 650-0017, Japan
[b] Toshiba Medical Systems Corporation, 1385 Shimoishigami, Otawara, Tochigi 324-8550, Japan
[c] Department of Radiology, Kochi Medical School, Nankoku, Kochi 783-8505, Japan

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ABSTRACT

Purpose: To evaluate potential benefits of using multiplanar reconstruction (MPR) in computer-aided detection (CAD) of lung nodules on multidetector computed tomography (MDCT).
Materials and methods: MDCT datasets of 60 patients with suspected lung nodules were retrospectively collected. Using "second-read" CAD, two radiologists (Readers 1 and 2) independently interpreted these datasets for the detection of non-calcified nodules (≥4 mm) with concomitant confidence rating. They did this task twice, first without MPR (using only axial images), and then 4 weeks later with MPR (using also coronal and sagittal MPR images), where the total reading time per dataset, including the time taken to assess the detection results of CAD software (CAD assessment time), was recorded. The total reading time and CAD assessment time without MPR and those with MPR were statistically compared for each reader. The radiologists' performance for detecting nodules without MPR and the performance with MPR were compared using jackknife free-response receiver operating characteristic (JAFROC) analysis.
Results: Compared to the CAD assessment time without MPR (mean, 69 s and 57 s for Readers 1 and 2), the CAD assessment time with MPR (mean, 46 s and 45 s for Readers 1 and 2) was significantly reduced ($P < 0.001$). For Reader 1, the total reading time was also significantly shorter in the case with MPR. There was no significant difference between the detection performances without MPR and with MPR.
Conclusion: The use of MPR has the potential to improve the workflow in CAD of lung nodules on MDCT.

1. Introduction

In recent years, it has become commonplace to acquire thin-section volumetric images of the entire thorax with multidetector computed tomography (MDCT). Although thin-section CT images better depict lung nodules than thick-section images, a large number of images to be inspected per CT examination amount to the increase in the workload of radiologists, with the ever-present risk of overlooking lung cancer [1–4]. Computer-aided detection (CAD) holds promise as a safeguard against this risk, as many studies have shown that CAD can improve the performance of radiologists in pulmonary nodule detection on CT [5–10].

On the other hand, volumetric CT acquisition enables the production of high-resolution multiplanar reconstruction or reformation (MPR) images, and there are various reports on the utility of MPR in chest CT for the evaluation of lung parenchyma, airways, lung cancer, and pulmonary embolism [11–16]. However, while the use of MPR has been mentioned in recent studies on lung nodule CAD software [8–10], potential benefits of using MPR in the setting of CAD have not been investigated. Thus, the purpose of this study was to explore whether the use of MPR contributes to CAD of lung nodules on MCDT, or more specifically, whether the availability of coronal and sagittal MPR images has beneficial effects on the detection performance and workflow of radiologists in this CAD.

2. Materials and methods

2.1. Image data collection

This study was undertaken with the approval of our institutional review board. Among the patients who underwent outpatient CT examinations in 2006 for suspicion of a solitary pulmonary nodule

* Corresponding author. Tel.: +81 78 382 6104; fax: +81 78 382 6129.
E-mail addresses: sumatsu@med.kobe-u.ac.jp (S. Matsumoto), yoshirad@kobe-u.ac.jp (Y. Ohno), hitoshi.yamagata.@toshiba.co.jp (H. Yamagata), aznogami@med.kobe-u.ac.jp (M. Nogami), akono@med.kobe-u.ac.jp (A. Kono), sugimura@med.kobe-u.ac.jp (K. Sugimura).
[1] Tel.: +81 78 382 6104; fax: +81 78 382 6129.
[2] Tel.: +81 287 26 6488; fax: +81 287 26 6053.
[3] Tel.: +81 88 880 2220; fax: +81 88 880 2260.

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and gave written informed consent for the use of image data for research, CT image datasets of 60 patients (37 men and 23 women; age range, 27–84 years; mean age, 67 years) were retrospectively selected. Inclusion criteria were cases with histologically proven primary or metastatic lung cancer less than 3 cm in diameter, cases with lung nodules that were stable for a subsequent follow-up period of at least 2 years, or cases that turned out to be without nodules. Cases with considerable atelectasis, consolidation, or fibrosis

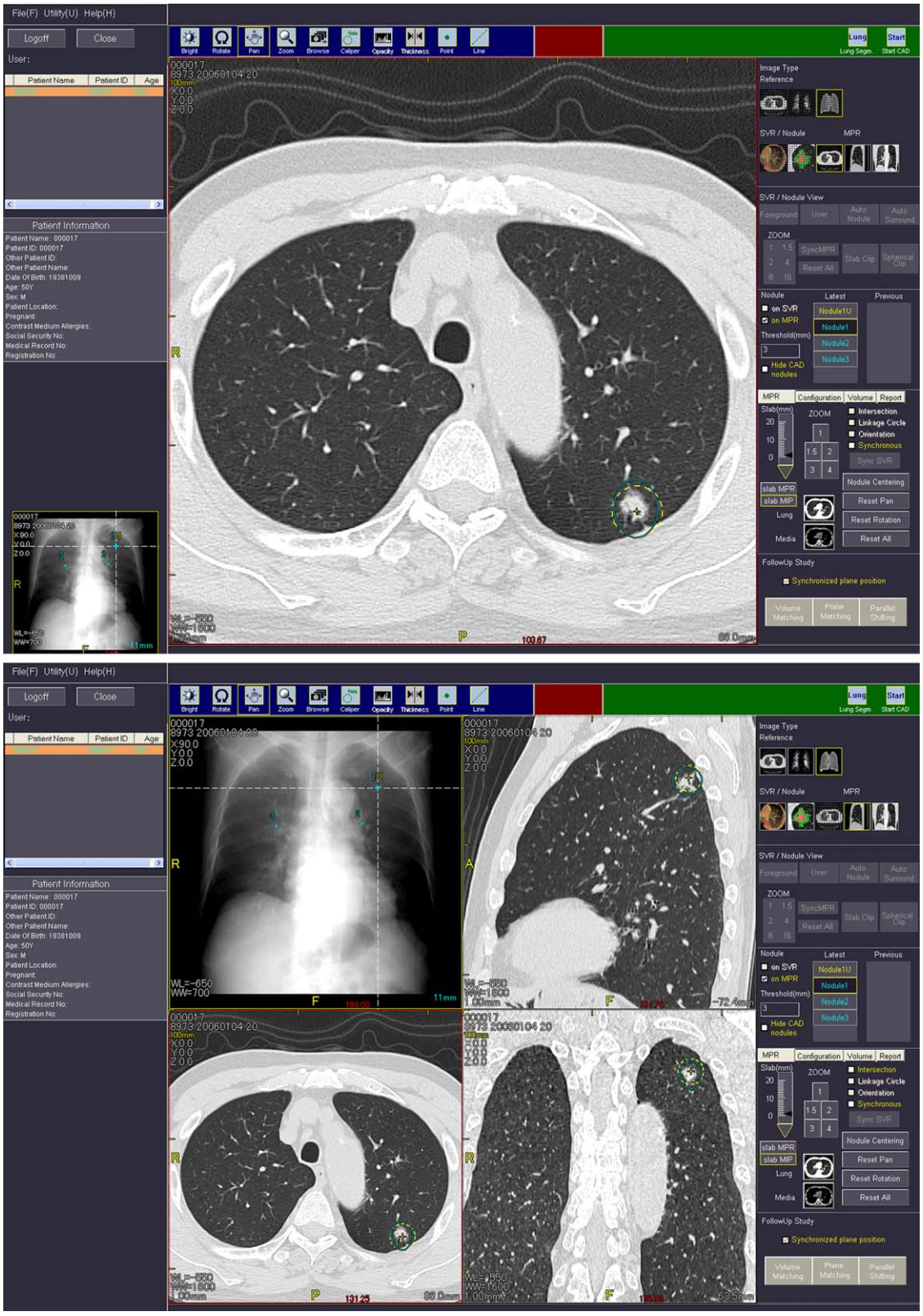

Fig. 1. User interface of CAD software in basic display mode (top) and orthogonal MPR mode (bottom) showing images through a nodule (proven to be adenocarcinoma) with corresponding CAD and non-CAD findings (indicated by a green ellipse and a yellow dashed circle, respectively). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the article.)