Preliminary assessing no-surgical treatment response in bronchogenic carcinoma with three-phase contrast material-enhanced MRI

Shenjiang Li, Feng Zhu, Xuefeng Cui, Debin Liu, Wenjie Liang, Yan Zhu, Wenjie Bi

Department of Imageology, The Eighty-eighth Military Hospital, Tai’an 271000, China

Received: 4 July 2010 / Revised: 20 July 2010 / Accepted: 25 July 2010
© Huazhong University of Science and Technology and Springer-Verlag Berlin Heidelberg 2010

Abstract  Objective: The aim of this study was to evaluate the efficacy of three-phase contrast material-enhanced MRI in assessing no-surgical treatment response in peripheral bronchogenic carcinoma preliminarily. Methods: Twenty-two patients with bronchogenic carcinoma after no-surgical treatment underwent three-phase contrast material-enhanced MRI. Three scans were obtained at 25 s, 120 s and 180 s respectively after nonionic contrast material was administrated via the ante-cubital vein at a rate of 2 mL/s by using an autoinjector. Precontrast and postcontrast signal intensity on every scan was recorded. Peak Height (PH) and Maximum Enhancement (Emax) were calculated. Enhancement pattern was evaluated on the images obtained at 120 s and 180 s after injection of contrast medium. Results: Precontrast signal intensity, postcontrast signal intensity at 120 s and 180 s were 478 ± 108, 926 ± 209 and 1050 ± 252. PH (571 ± 225) and Emax (119 ± 49) of bronchogenic carcinoma after no-surgical treatment were significantly lower than those of bronchogenic carcinoma without any therapy (mean PH 655, mean Emax 150) (t = 2.178, P = 0.005 < 0.05, t = 4.196, P = 0.001 < 0.05). Six cases among 22 appeared homogeneous enhancement at 180 s. At 120 s, there were 4 cases with inhomogeneous enhancement, 1 case with homogeneous enhancement, 1 case with peripheral enhancement among the 6 cases. Conclusion: Bronchogenic carcinoma after no-surgical treatment shows a gradual increase to the PH after administration of contrast material. Three-phase contrast material-enhanced MRI can reflect the blood supply of bronchogenic carcinoma and might be effective approach for evaluation of no-surgical treatment response in bronchogenic carcinoma.

Key words bronchogenic carcinoma; MRI; image enhancement; evaluation of curative effect

Lung cancer continues to be a major health problem. It is the most common malignancy all over the world and accounts for the greatest number of cancer related deaths in both men and women [1-3]. Early surgical treatment in early bronchogenic carcinoma in believed to be the most means. Unfortunately, because more than 80% patients have advanced disease at presentation in China [3], treatment options are limited to no-surgical treatment. Imaging modality is the most common and effective modality used to assess no-surgical treatment response in bronchogenic carcinoma.

At present, tumor has been proved to be a kind of disease depending on angiogenesis [4-6]. Anti-angiogenic therapy in tumor developed rapidly in recently years. Changes in tumor size has been being index for evaluation of treatment response in many solid tumors, such as bronchogenic carcinoma, in many years. While changes in tumor size can not reflect bronchogenic carcinoma angiogenesis. Quantifying therapeutic effect with use of changes in tumor size only has highlighted problems in clinical practice. Dynamic contrast-enhanced MRI can provide information about bronchogenic carcinoma angiogenesis [7]. The aim of this study was to evaluate the efficacy of three-phase contrast material-enhanced MRI in assessing no-surgical treatment response in peripheral bronchogenic carcinoma preliminarily.

Materials and methods

Patients

Patients were selected according to the following criteria: (a) being confirmed histologically, (b) stopping treatment more than one month, (c) probable ability to cooperate with the procedure. Twenty-five patients with bronchogenic carcinoma after no-surgical treatment met the criteria and underwent three-phase contrast material-enhanced MRI between 2005 and 2009. Three patients
because of artifact were excluded from the study. Twenty-two patients (18 men, 14 women; age range 37–76 years; mean age 56.59 years ± 10.08 [standard deviation]) with bronchogenic carcinoma after no-surgical treatment 1.76–7.42 cm (mean, 3.60 cm ± 1.37 cm) were studied. Final diagnosis were confirmed histologically by means of surgery, CT-guided transthoracic needle aspiration biopsy. The 22 patients (adenocarcinoma in 17 patients, squamous cell carcinoma in 5 patients, adenosquamous carcinoma in 6 patients, small cell lung cancer in 2 patients, bronchioalveolar carcinoma in 2 patients) were included into the study.

**Protocol**

Before the examination, patients were carefully instructed in and practiced the breath-holding technique to reproduce precisely the same degree of inspiration for each scan series.

All MR studies were performed by using a 1.5-T superconducting magnet and a array body coil. The fast low angle shot (FLASH) 2D sequence parameters for the T1 weighted imaging were TR = 142 ms, TE = 41 ms and the turbo spin echo (TSE) sequence for the T2 weighted imaging were TR = 44 ms, TE = 64 ms. Precontrast scan included transversal coronary and sagittal. Dynamic MR used transversal imaging (5–6 mm slice thickness 128 × 256 matrix pixels 24 cm × 38 cm field-of-view). The parameters enabled us to acquire 12–15 slice with in 15 s scan time. The three spiral MR scans were obtained beginning at 25 s, 120 s and 180 s after injection of contrast medium respectively. Magnevist Schering Ltd (2 mL/s 0.1 mmol/kg) was administrated via the antecubital vein by using an autoinjector, 15 mL saline solution was then administrated at the same rate.

**Data analysis**

The region of interest was as large as possible to minimize noise but with care to avert partial-volume effect. According to this criterion, the area of the region of interest was about 60% of the area of the lung nodule but with care to avert vesicles and necrosis. If there was substantial artifact from cardiac motion, the image was eliminated from data analysis. Precontrast and postcontrast signal intensity on every scan was recorded. Peak Height (PH) and Maximum Enhancement (Emax) were calculated. PH = SImax – SIpre. Emax = [SImax – SIpre] / SIpre × 100%. Simax standed for the maximum of signal intensity after injection of contrast medium and SIpre standed for baseline precontrast signal intensity.

Enhancement pattern was classed as follows: homogeneous, if enhancement of the nodule was completely homogeneous; heterogeneous, if enhancement of the nodule was completely heterogeneous; central, if enhancement was at the inner area of the nodule; peripher-

**Results (Table 1 and Fig. 1)**

PH (571 ± 225) and Emax (119 ± 49) of bronchogenic carcinoma after no-surgical treatment were significantly lower than those of bronchogenic carcinoma without any therapy (mean PH 655, mean Emax 150) (t = 2.178, P = 0.005 < 0.05, t = 4.196, P = 0.001 < 0.05).

**Discussion**

Lung cancer continues to be a major health problem. In recently years, the incidence of bronchogenic carcinoma and resultant mortality is rising. It is the most common malignancy all over the world and accounts for the greatest number of cancer-related deaths in both men and women [1–3]. Treatment options for lung cancer to date have included surgery and radical radiation therapy for potentially curable tumors and chemotherapy and palliative radiation therapy for more advanced tumors. Early surgical treatment in early bronchogenic carcinoma in believed to be the most means. Unfortunately, because more than 80% patients have advanced disease at presentation in China [3], treatment options are limited to no-surgical treatment.

Accurate evaluation of therapeutic effect is necessary