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Bronchial artery embolization to control hemoptysis in patients with *Mycobacterium avium* complex

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ABSTRACT

Background: Hemoptysis frequently develops in patients with *Mycobacterium avium* complex (MAC) pulmonary disease. Bronchial artery embolization (BAE) has been established as one of the useful treatments of massive and persistent hemoptysis. We evaluated the efficacy and safety of BAE for controlling hemoptysis in MAC patients, and identified the risk factors of rebleeding after BAE.

Methods: Among the 529 patients with MAC who were admitted to our institution from January 2007 to December 2012, we retrospectively reviewed the demographic data, imaging, sputum, and angiographic findings, and the clinical course of 43 patients who underwent BAE using coils, due to hemoptysis.

Results: Among the 43 patients enrolled in the study, rebleeding developed in 13 cases (30.2%) with a mean follow-up period of 18 months. Median rebleeding-free time after BAE was 29.9 months and the cumulative hemoptysis control rates were 79.1%, 73.8%, and 63.3% in one, two, and three years, respectively. Rebleeding-free time significantly correlated with comorbid chronic pulmonary aspergillosis (CPA). When limited to 35 MAC patients without CPA, the rate increased to 88.6%, 82.1%, and 70.4%, respectively. Factors such as coexisting CPA, multiple embolized vessels at BAE, longer length of time from the diagnosis of MAC to BAE, and an administration of antibiotics for MAC at the time of hemoptysis, indicated statistically significant correlations with rebleeding. Major complications concerning BAE were not encountered.

Conclusions: BAE using coils is an effective and safe method for controlling hemoptysis in patients with MAC pulmonary disease. However, it is important to carefully observe patients with risk factors for rebleeding after BAE.

Abbreviations: BAE, bronchial artery embolization; BMI, body mass index; CPA, chronic pulmonary aspergillosis; MAC, *Mycobacterium avium* complex; NTM, nontuberculous mycobacterial

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1. Introduction

The number of nontuberculous mycobacterial (NTM) pulmonary diseases has been increasing in Japan as well as in many Asian countries, the United States, Netherlands, and Australia [1–5]. The estimated incidence rate in Japan has increased from 1.5 per 100,000 in 1985 to 3.52 in 1997 [6]. *Mycobacterium avium* complex (MAC); i.e. *Mycobacterium avium* or *intracellulare*, is the most prevalent pulmonary pathogen among the NTM cases in Japan [7]. Hemoptysis frequently develops [5] during its clinical course and is often difficult to control with an administration of antibiotics for MAC. Since hemoptysis may impede patients' daily living, specific treatments for hemoptysis are needed.

After bronchial artery embolization (BAE) was introduced by Remy et al. in the 1970s [8], it has been established as one of the useful treatments for massive and persistent hemoptysis. Although surgical resection of the lung, including the bleeding area, is considered as a definitive treatment for hemoptysis [9], hemoptysis in many patients is inoperable because of old age and/or limited lung capacity due to chronic pulmonary diseases. In such inoperable patients, BAE has been considered a safe alternative therapeutic approach for hemoptysis [10–13].

Clinical outcomes after BAE vary depending on the underlying lung diseases [14]. Although the efficacy and safety of BAE for controlling hemoptysis due to pulmonary tuberculosis were previously reported, there have not been prior studies regarding BAE for patients with bleeding due to MAC pulmonary disease. The aim of this retrospective study was to evaluate the efficacy and safety of BAE by detachable coils in order to control hemoptysis due to MAC pulmonary disease, as well as to clarify the risk factors for rebleeding after BAE.

2. Patients and methods

2.1. Patients

Among the consecutive 529 patients with MAC pulmonary disease admitted at our hospital, from January 2007 to December 2012, we retrospectively reviewed the medical records of 77 patients who have been admitted for the control of hemoptysis (Fig. 1). MAC pulmonary disease was diagnosed based on the 2007 American Thoracic Society and Infectious Diseases Society of America criteria [15]. Among the 77 patients with hemoptysis, BAE was performed in 45 patients. Forty-three of these 45 patients were followed up for more than a year or until rebleeding after BAE, and divided into the rebleeding and non-rebleeding groups. The demographic data, imaging, and sputum findings, and clinical course of these 43 patients were assessed in order to evaluate the outcomes of BAE and the risk factors for rebleeding after BAE. Performance status was evaluated in each patient using the scoring system of the World Health Organization. Patients with rebleeding were defined as those who required readmission to control recurrent hemoptysis after BAE. In this study, imaging findings were determined according to the consensus of two radiologists. The cases were considered as complicated by chronic pulmonary aspergillosis (CPA), when the chest CT findings were consistent with CPA plus one or more positive findings of *Aspergillus* infection, including a positive sputum or bronchial wash culture, positive serum anti-*Aspergillus* antibody or *Aspergillus* antigen. For each patient, the end of follow-up was defined as the date of rebleeding after BAE or the last day of December 2013.

This retrospective study was conducted at the Tokyo National Hospital located in Kiyose, Tokyo, Japan and approved by the institutional review board of the hospital (approval date: July 23, 2014; approval number: 140034).

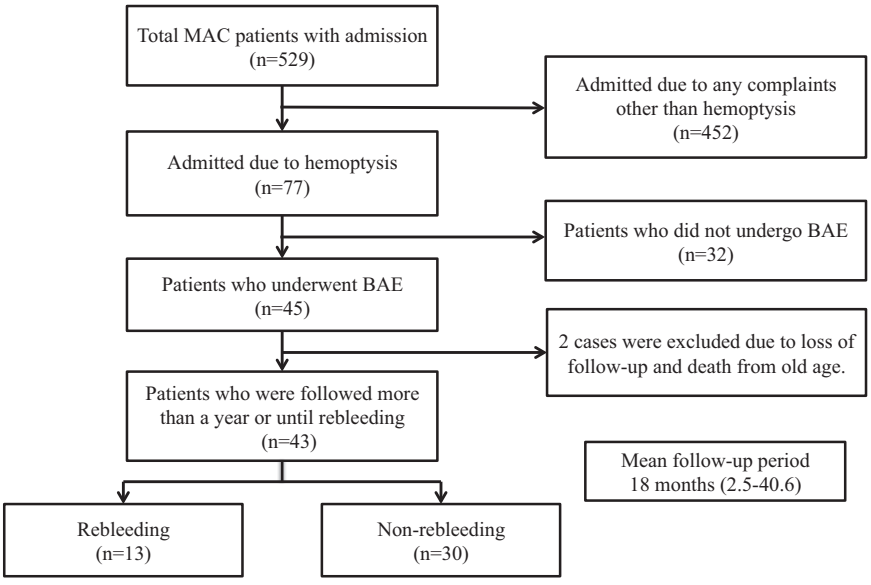

Fig. 1 – Diagram of the process of study population selection. BAE, bronchial artery embolization; MAC, *Mycobacterium avium* complex.