


# An effective case of bronchoscopic balloon dilatation for tuberculous bronchial stenosis

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## Abstract

Endobronchial tuberculosis often causes bronchial stenosis. Balloon dilation is a minimally invasive and effective bronchoscopic intervention for bronchial stenosis; however, reports on balloon dilation in older individuals are limited. We present a case of a 77-year-old woman with endobronchial tuberculosis and clarify the efficacy and safety of balloon dilation. She presented with dyspnea, right lung atelectasis, and respiratory failure 55 days after initiation of antituberculosis therapy. We performed bronchoscopic balloon dilatation for the right main bronchial stenosis. Consequently, respiratory failure rapidly improved. Chest computed tomography (CT) showed improved lung atelectasis; however, severe bronchial stenosis and rhonchi persisted. Therefore, we performed a second balloon dilatation. CT 3 months after the first balloon dilation showed right upper bronchial stenosis and right lung middle lobe atelectasis. Restenosis was absent 21 months after third balloon dilatation. Bronchoscopic balloon dilation is effective for restenosis with repeated treatment and can be safely performed in older individuals.

## KEYWORDS

balloon dilatation, bronchial stenosis, bronchial tuberculosis

## INTRODUCTION

Tuberculosis (TB) is a global health concern and a common disease in older individuals in Japan. The proportion of those aged 80 years and above among the total notified TB cases was 29.9% ( $n = 3440/11,519$ ), and of those aged 70 years and above was 63.5% ( $n = 7314$ ), as reported by the Ministry of Health, Labour and Welfare in Japan in 2021.

Endobronchial TB (EBTB) causes bronchial stenosis; therefore, various endoscopic interventions may be required.<sup>1</sup> Balloon dilatation is less invasive and has a high restenosis rate compared with the other interventions, and repeated performance is considered safe in older patients. This study presents the case of an older patient with tuberculous bronchial stenosis treated with repeated balloon dilatation to aid clinicians in persistent atelectasis and respiratory failure.

## CASE REPORT

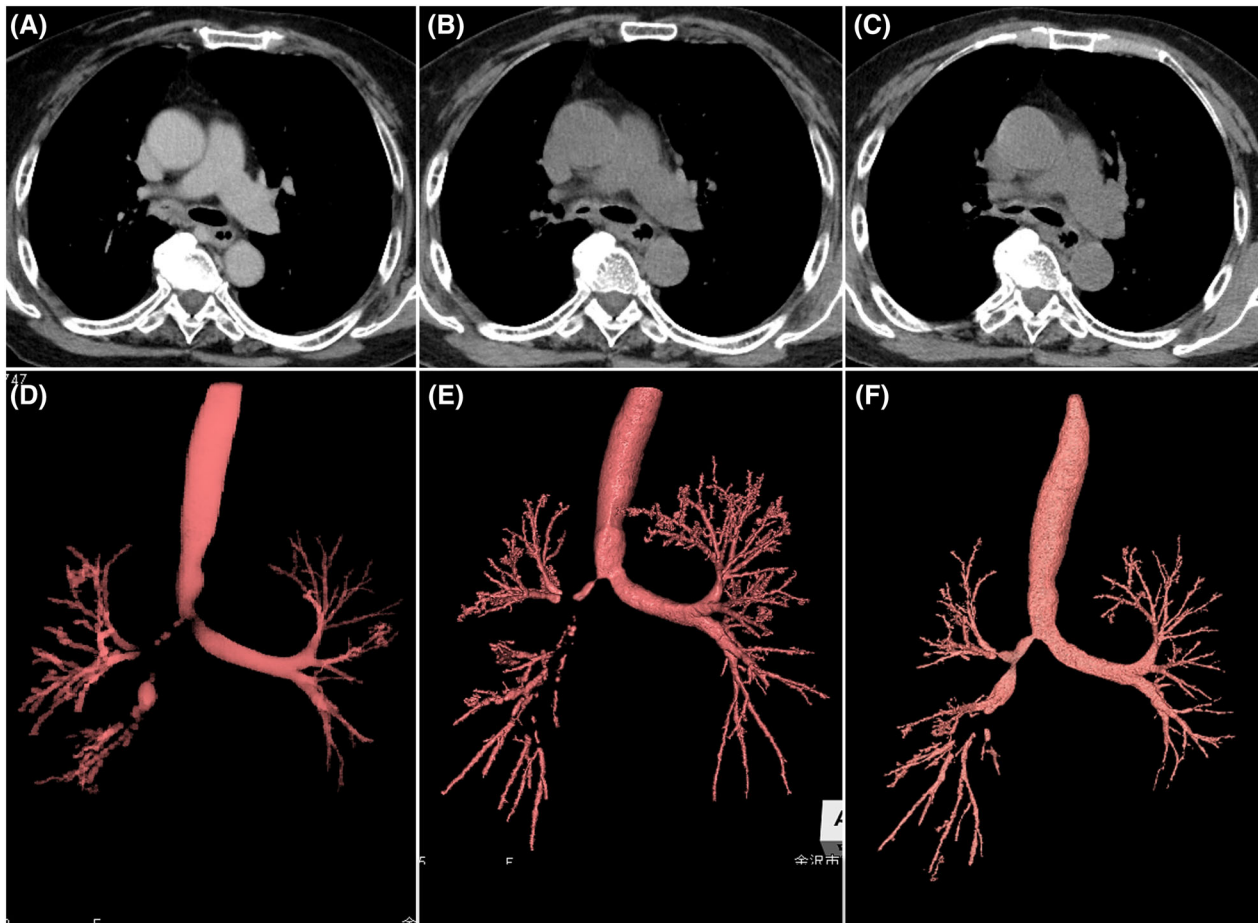
A 77-year-old woman had chronic productive cough and appetite loss and lost 10 kg of weight in 3 months. Chest computed tomography (CT) revealed multiple granular shadows in all lung fields, nodular shadows in the right upper lobe, and bronchial stenosis with thickening of the bronchial lumen from the right main bronchus to the bronchus intermedius. Acid-fast bacterial staining of sputum was smear-positive, and polymerase chain reaction for TB was positive. The patient was diagnosed with pulmonary and endobronchial tuberculosis and was admitted to the isolation ward of our hospital.

Physical examination revealed temperature, 37°C; blood pressure, 134/81 mmHg; pulse rate, 90 beats/min; and oxygen saturation, 97%. Her breath sounds were rhonchi.

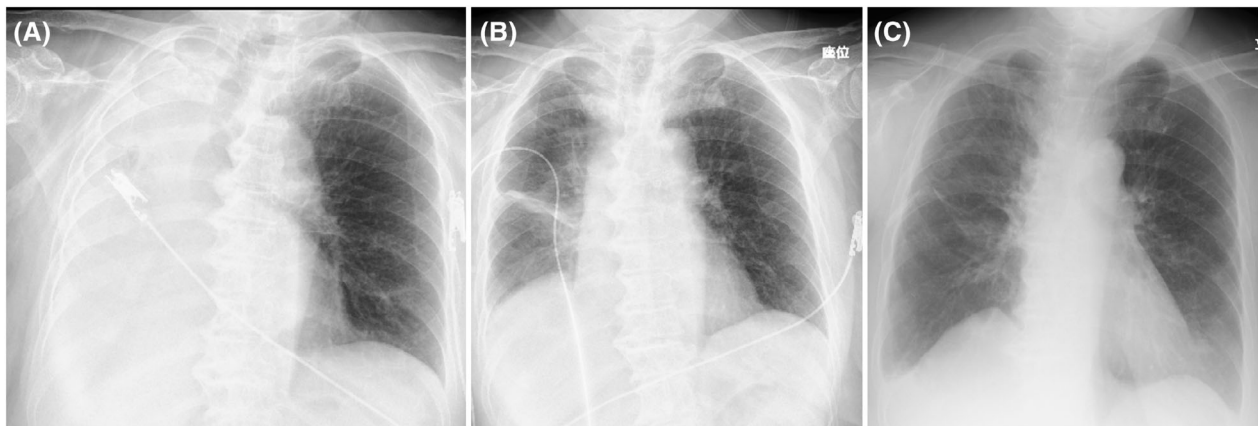
Right lower lobe atelectasis and respiratory failure appeared on the 55th day of anti-TB medications. One week

later, CT showed obstruction of the right main bronchus (Figure 1A, D) and exacerbation of right atelectasis on chest X-ray (Figure 2A); therefore, she underwent flexible bronchoscopic balloon dilation under general anaesthesia. Bronchoscopy

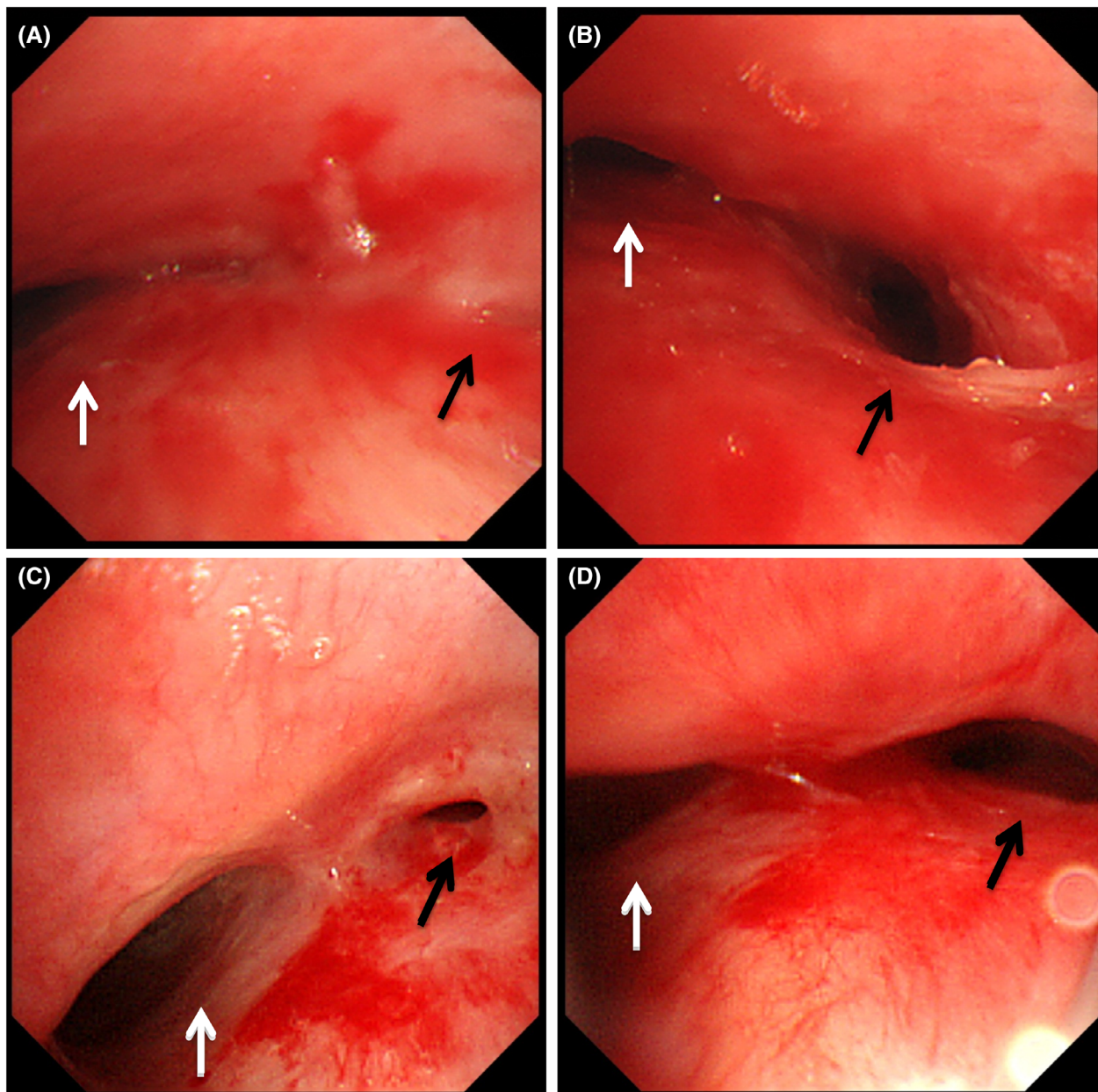
(1 T-260; Olympus Corporation, Tokyo, Japan) revealed that the right main bronchus was completely obstructed (Figure 3A). The bronchial stenosis was treated using CRE™ Pulmonary Balloon Dilator (No. 5033) (Boston Scientific Corporation,



**FIGURE 1** The course of chest computed tomography & virtual 3D bronchial model. (A) Before the first balloon dilatation, computed tomography (CT) showed that the right main bronchus was almost completely obstructed. (B) Before the third balloon dilatation, CT showed that the right main bronchus stenosis persisted. (C) Four months after the third balloon dilatation, right main bronchus stenosis was improved. Virtual 3D bronchial model constructed from CT slices. (D) Before the first balloon dilatation. (E) Before the third balloon dilatation. (F) Four months after the third balloon dilatation.



**FIGURE 2** The course of chest x-ray. (A) Before the first balloon dilatation, right atelectasis is visible. (B) One day after the first balloon dilatation, right atelectasis was almost improved. (C) One week after the first balloon dilatation, right atelectasis disappeared.



**FIGURE 3** Bronchoscopic image. The black arrow shows the right main bronchus; the white arrow shows the left main bronchus. (A) Before the first balloon dilatation, the right main bronchus was almost completely obstructed. (B) After the first balloon dilatation, the right main bronchial lumen expanded. (C) Before the third balloon dilatation, restenosis of the right main bronchus was observed. (D) After the third balloon dilatation, stenosis of the right main bronchus improved.

Marlborough, MA, USA) with the pressure increased to 3 atm to dilate the right main bronchus for 30 s. After the balloon dilatation was repeated thrice, the bronchial lumen expanded (Figure 3B), and the right atelectasis improved within 1 week after the balloon dilatation (Figure 2B, C). Severe bronchial stenosis persisted, and bronchoscopy was performed again 2 weeks after the first balloon dilatation. The stenosis of the bronchus intermedius was treated by increasing the pressure to 3 atm for 30 s and 9 atm for 30 s. Three months after the first balloon dilatation, CT showed the right main bronchus restenosis (Figure 1B, E). The patient underwent the third balloon dilatation. Bronchoscopic high-pressure (9 atm) balloon dilatation

was performed six times for the right main bronchial stenosis (Figure 3C) and thrice for the bronchus intermedius stenosis, with 30 s per cycle. The bronchoscope was passed through the bronchial stenosis following the procedure (Figure 3D). Restenosis was not observed from 4 to 21 months after the third balloon dilatation (Figure 1C, F).

## DISCUSSION

Bronchoscopic intervention can be less invasive than surgical treatment and is helpful for tuberculous endobronchial

stenosis. Various interventions, such as balloon dilatation, laser resection, electrocautery, cryotherapy, and stent implantation have been proposed.<sup>1,2</sup>

Balloon dilation is less effective in cases of bronchial stenosis complicated by bronchomalacia, and stent implantation may be useful in some cases.<sup>1</sup> However, balloon dilation alone seems to be sufficient in many cases.<sup>3,4</sup> In this case, after the first balloon dilatation, atelectasis improved, but bronchial stenosis persisted. Despite the second balloon dilatation, bronchial stenosis was severe; therefore, a paediatric Dumon stent (diameter 9 mm) could not be implanted. Single or multiple balloon dilatations were successful in 82 patients (73%) with tuberculous tracheobronchial stenosis, with a mean follow-up of 30.3 months.<sup>3</sup> Lee followed up 131 patients with tracheobronchial stenosis due to tuberculosis for 5 years and found that 19 patients (29.7%) underwent balloon dilatation alone.<sup>2</sup> Repeated use of balloon dilatation resulted in avoiding the need for stent placement, resulting in a less invasive approach for the patient and reducing the risk of complications such as granulation tissue growth and stent migration.

We performed three balloon dilatations over 3 months and observed no recurrence for 21 months subsequently. Cho et al. reported that symptoms recurred from 1 day to 113 months (mean, 13 months) after repeated balloon dilatation.<sup>3</sup> Restenosis may occur after a long period, and further long-term observations are therefore necessary in this case.

In previous reports, patients had a mean age of 37 years<sup>3</sup> and  $50 \pm 18$  years.<sup>2</sup> Limited reports are available on older patients. This case report suggests that repeated balloon dilation may be minimally invasive, even in elderly patients.

There is no established standard technique for balloon dilation; therefore, balloon pressure and dilation duration vary. In many cases, the balloon pressure was 3–5 atm with the highest pressure being 16 atm.<sup>5</sup> The reported dilation duration varied widely, and was 10–30 s in many cases, but the longest time was 40 min.<sup>4,5</sup> Fu et al. reported that by increasing the duration of balloon dilatation alone at a high pressure of 14 atm and a duration of 40 min, restenosis was not observed, and complications were absent.<sup>4</sup> Further consideration should be given to the optimal duration of dilatation required to avoid restenosis, as well as the safety of balloon dilatation with higher pressure and a longer time. The procedure depends on the state of the bronchial walls and each patient's respiratory condition; therefore, it is difficult to standardize the balloon pressure, dilatation duration, and frequency.

We report a case in which bronchoscopic balloon dilation was effective in treating tuberculous bronchial stenosis. Balloon dilation quickly improves the patient's symptoms and is effective for restenosis with repeated treatment, suggesting that it can be safely performed in older patients. Evaluation of the long-term prognosis is warranted.

## AUTHOR CONTRIBUTIONS

Yukari Ichikawa cured for the patient, prepared the data, and edited the manuscript. Koji Kurokawa and Shiho Furusho cured for the patient. Yasuto Nakatsumi, Masahide Yasui reviewed the manuscript. Nobuyuki Katayama drafted and reviewed the manuscript. All authors approved the final manuscript.

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## CONFLICT OF INTEREST STATEMENT

None declared.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## ETHICS STATEMENT

The authors declare that appropriate written informed consent was obtained for the publication of this manuscript and accompanying images.

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