



# Successful treatment of tracheal stenosis due to a broken uncovered metallic stent placed over 20 years ago in a patient with recurrent polychondritis using argon plasma coagulation and airway ballooning

Yuki Takigawa  | Ken Sato | Kenichiro Kudo | Takeru Ichikawa | Yuto Sasano | Shoichiro Matsumoto | Tomoyoshi Inoue | Miho Fujiwara  | Suzuka Matsuoka | Hiromi Watanabe | Akiko Sato | Keiichi Fujiwara | Takuo Shibayama

Department of Respiratory Medicine, NHO Okayama Medical Center, Okayama, Japan

## Correspondence

Yuki Takigawa, Department of Respiratory Medicine, National Hospital Organization Okayama Medical Center, 1711-1 Tamasu, Okayama city, Okayama 701-1192, Japan.  
Email: tacky1024@gmail.com

Associate Editor: Jane Winantea

## Abstract

A woman in her mid-60s with recurrent polychondritis was admitted to our hospital due to airway stenosis secondary to an uncovered metallic stent. She underwent a bronchoscopic intervention under general anaesthesia. During the procedure, the stent fracture was cauterized using Argon Plasma Coagulation (APC) cauterisation, performed with argon flow at 1 L/min and power set at 70 W. APC cauterisation caused the stent wire to flex circularly, gradually improving the stenosis. Tracheal dilatation was then performed using an airway balloon. Following the ballooning, a thin bronchoscope was easily passed through the lower trachea, and the left and right main bronchi were observed; therefore, the procedure was completed without any complications. APC coagulation and airway ballooning are viable choices for the temporary treatment of airway stenosis due to broken metallic stents.

## KEYWORDS

airway stenosis, argon plasma coagulation, recurrent polychondritis, Ultraflex stent

## INTRODUCTION

Self-expandable metallic stents are an effective treatment for airway stenosis; however, long-term implantation can cause damage and re-stenosis due to metal fatigue. Removing stents embedded in the tracheal mucosa is challenging, with a high risk of bleeding and worsening of stenosis. Currently, there is no consensus on how to manage broken stents except for stent removal. In this report, we present a case in which we could treat a broken stent with Argon plasma coagulation (APC) and ballooning.

## CASE REPORT

In 2002, a woman in her 40s with recurrent polychondritis was admitted to another hospital. Despite treatment, her

airway stenosis was resistant to steroid therapy. In 2003, Ultraflex stents (uncovered) were placed in the trachea and bronchi at another hospital to secure the airway for airway stenosis due to recurrent polychondritis (Figure 1). In 2018, granulation around the stent was observed, and although stent removal was deemed necessary at another hospital, it was considered difficult due to the high risk of haemorrhage.

In 2024, difficulty was experienced in inserting a suction tube through her tracheotomy speech cannula. Observation by otolaryngologist at the previous hospital revealed tracheal stenosis due to a broken stent wire from the Ultraflex stent placed over 20 years ago (Figure 2). The patient was then referred to the NHO Okayama Medical Center for airway intervention.

First, we performed bronchoscopy under intravenous anaesthesia. Using a thin bronchoscope (BF-P290F, OLYMPUS), stenosis was observed through tracheostomy. A nitinol

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial](https://creativecommons.org/licenses/by-nc/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2024 The Author(s). *Respirology Case Reports* published by John Wiley & Sons Australia, Ltd on behalf of The Asian Pacific Society of Respiriology.

stent wire from the damaged Ultraflex stent was found to be spirally protruding into the centre of the airway lumen from the right side of the lower trachea, with a part of the stent wire sharply protruding into the centre. For both diagnostic and therapeutic purposes, we cauterized the broken stent wire using APC (ERBE™, Tübingen, Germany) and trimmed the broken section (Figure 3).

Subsequently, the patient underwent a bronchoscopic intervention under general anaesthesia. Using Trachiosoft™ Evac (7.5-mm inner diameter, Medtronic, Ireland) with a swivel connector through a tracheostomy, the stent fracture was cauterized by APC using a thin bronchoscope (BF-P290F, OLYMPUS, Japan). Only the stent wires protruding strongly

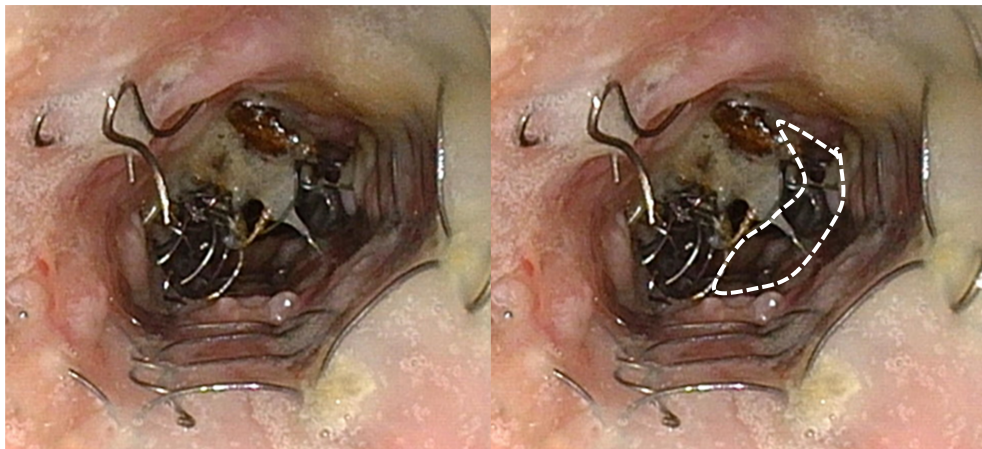
into the centre of the tracheal lumen were cauterized, and stent wires not involved in the stenosis were cauterized as little as possible. Following previous reports,<sup>1</sup> we performed APC cauterisation with supplemental oxygen maintained at less than 40%, argon flow at 1 L/min, and power set at 70 W. The activation time for APC cauterisation was 2–4 s, with the probe positioned either parallel or perpendicular to the end of the stent fragment to minimize collateral damage to the tracheal mucosa. The broken stent wire flexed circularly during APC cauterisation, and the stenosis gradually improved. APC cautery was considered complete when the sharp stent wire was no longer present. An airway balloon (10-11-12 CRE Pulmonary Balloon Dilator, Boston Scientific, USA) was used for dilatation. Any unnecessary stent wire that could be removed was extracted using forceps biopsy. After ballooning, a thin bronchoscope could easily pass through the lower trachea, allowing clear observation of the left and right main bronchi, and the procedure was completed (Figure 4A–E). Two weeks after the intervention, follow-up bronchoscopy showed significant improvement in the airway stenosis (Figure 4F). The suction tube could be easily passed after the patient slightly turned her neck to the right. Additionally, she no longer choked on sputum, and her respiratory condition improved. In the long term, customized speech cannulas or stent-in-stent therapy must be considered as additional therapy.



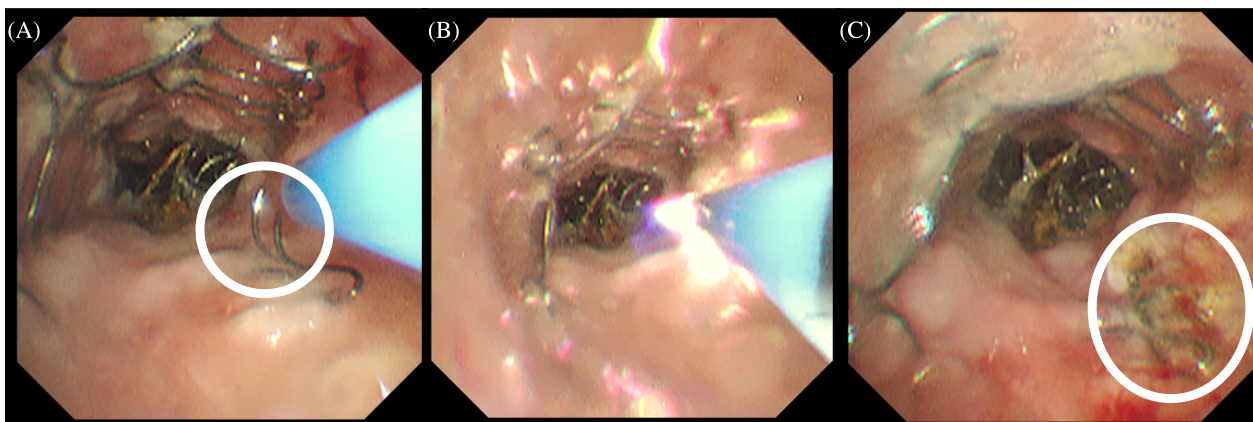
**FIGURE 1** Bronchial trees (green) and airway stents placed over 20 years earlier (yellow) were observed using reconstructed computed tomography images on the workstation SYNAPSE VINCENT (Fujifilm Medical Systems, Tokyo, Japan).

## DISCUSSION

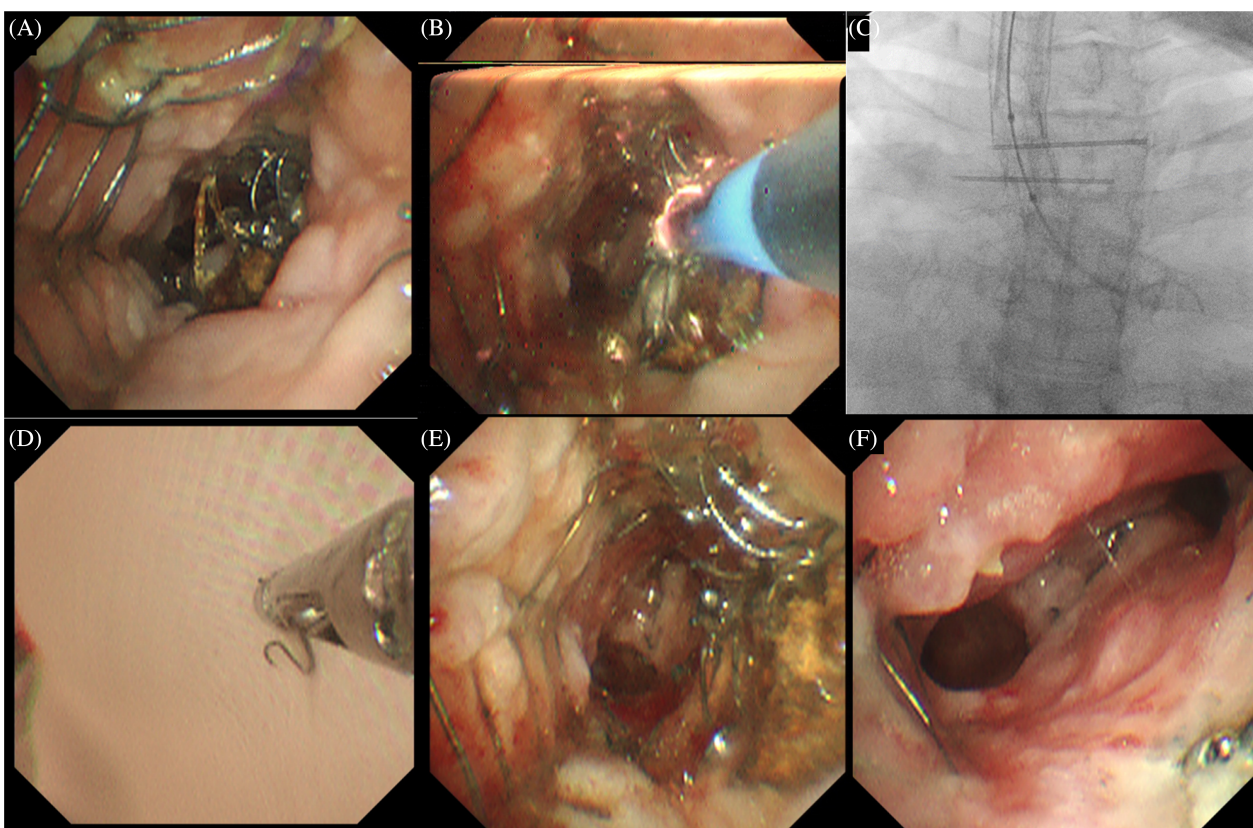
Self-expanding metallic stents have been reported to be effective in treating central airway stenosis caused by recurrent polychondritis (RP).<sup>2–4</sup> Ultraflex stents have been used in Japan since April 2000 to treat malignant airway stenosis. The uncovered metallic stent itself is flexible, making it suitable for insertion into irregular airways such as those of patients with RP. Another advantage is the ease with which the sputum is expelled. However, long-term stent-related complications have been documented by Handa et al. particularly in patients with RP who underwent airway stent placement.<sup>5</sup> In this case,



**FIGURE 2** Fibre images obtained by the previous otolaryngologist. White dotted line shows the stenosis due to the broken stent wire.



**FIGURE 3** Flexible bronchoscopy obtained under intravenous anaesthesia. (A) Sharp fractured stent wire is shown in the white circle. (B) APC-cauterized broken stent wire. (C) The stent was trimmed by APC cauterisation.



**FIGURE 4** Interventional bronchoscopic images under general anaesthesia. (A) Broken stent wire causing tracheal stenosis. The stent wire obstructed the airway from the right side. (B) APC-cauterized broken stent wire. (C) x-Ray showing airway ballooning. (D) Fraction of the stent wire that could be removed using forceps. (E) Stenosis was improved by APC cauterisation and airway ballooning. (F) A thin bronchoscope could obtain an image of the carina after stenosis improvement.

stenting proved to be an effective treatment for a patient who was refractory to medication therapy, with respiratory symptoms remaining stable for at least 15 years after stenting. However, metal fatigue, particularly after prolonged survival and stent placement, is problematic. Removing a metallic stent embedded in the tracheal mucosa carries a high risk of

bleeding. In this case of tracheomalacia due to RP, there was a risk of worsening airway stenosis, even if the stent was removed successfully. The option of placing an additional stent from inside the existing Ultraflex stent was considered; however, this approach was rejected because of the difficulty in positioning the stent after placement and further narrowing of

the tracheal lumen. Therefore, we explored methods for coexistence with a stent placed over 20 years earlier. However, complications of metallic stents, such as fractures, airway ruptures, or restenosis due to granulation tissue and mucus, are sometimes fatal.<sup>6</sup>

Argon plasma coagulation (APC) (ERBE™, Tübingen, Germany) is a highly effective interventional device, with successful reports of APC trimming of both gastrointestinal<sup>7,8</sup> and airway metallic stents.<sup>1,9</sup> In this case, airway stenosis improved with a combination of APC and ballooning, which was an effective treatment. However, further long-term follow-up is required, as broken stents can still pose a risk of airway stenosis. APC coagulation and airway ballooning are viable choices for the temporary treatment of airway stenosis due to broken metallic stents.

### AUTHOR CONTRIBUTIONS

Yuki Takigawa and Ken Sato wrote the manuscript, which was reviewed by all co-authors. All authors have approved the final version of the manuscript for submission.

### ACKNOWLEDGMENTS

We would like to thank Dr. Masahide Oki from the NHO Nagoya Medical Center and Dr. Hideo Saka from Matsunami general Hospital, Daisuke Himeji and Ritsuya Shiiba from Miyazaki Prefectural Hospital, and Hiroshi Hannda from St. Marianna University. We would like to thank Editage ([www.editage.com](http://www.editage.com)) for English language editing.

### FUNDING INFORMATION

No funding was obtained for this study.

### CONFLICT OF INTEREST STATEMENT

None declared.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### ETHICS STATEMENT

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

### ORCID

Yuki Takigawa  <https://orcid.org/0000-0003-0613-0423>

Miho Fujiwara  <https://orcid.org/0009-0009-3790-4373>

### REFERENCES

- Ching YH, Geck RD, Andrews AD, Rumbak MJ, Camporesi EM. Argon plasma coagulation in the management of uncovered tracheal stent fracture. *Respir Med Case Rep.* 2014;13:37–8. <https://doi.org/10.1016/j.rmcr.2014.09.004>
- Gorard C, Kadri S. Critical airway involvement in relapsing polychondritis. *BMJ Case Rep.* 2014;2014:bcr2014205036. <https://doi.org/10.1136/bcr-2014-205036>
- Faul JL, Kee ST, Rizk NW. Endobronchial stenting for severe airway obstruction in relapsing polychondritis. *Chest.* 1999;116:825–7. <https://doi.org/10.1378/chest.116.3.825>
- Dunne JA, Sabanathan S. Use of metallic stents in relapsing polychondritis. *Chest.* 1994;105:864–7. <https://doi.org/10.1378/chest.105.3.864>
- Handa H, Ooka S, Shimizu J, Suzuki N, Mineshita M. Evaluation of airway involvement and treatment in patients with relapsing polychondritis. *Sci Rep.* 2023;13:8307. <https://doi.org/10.1038/s41598-023-35616-4>
- Chapron J, Wermert D, Le Pimpec-Barthes F, Cazes A, Pommier R, Hernigou A, et al. Bronchial rupture related to endobronchial stenting in relapsing polychondritis. *Eur Respir Rev.* 2012;21:367–9. <https://doi.org/10.1183/09059180.00000612>
- Demarquay JF, Dumas R, Peten EP, Rampa IP. Argon plasma endoscopic section of biliary metallic prostheses. *Endoscopy.* 2001;33:289–90. <https://doi.org/10.1055/s-2001-12813>
- Vanbiervliet G, Piche T, Caroli-Bosc FX, Dumas R, Peten EP, Huet PM, et al. Endoscopic argon plasma trimming of biliary and gastrointestinal metallic stents. *Endoscopy.* 2005;37:434–8. <https://doi.org/10.1055/s-2005-860989>
- Zantah M, Basile M, Burtulato M, Criner GJ. Endobronchial removal of uncovered stent using argon plasma coagulation via fiberoptic bronchoscopy. *Respirol Case Rep.* 2019;7:e00496. <https://doi.org/10.1002/rcr2.496>

**How to cite this article:** Takigawa Y, Sato K, Kudo K, Ichikawa T, Sasano Y, Matsumoto S, et al. Successful treatment of tracheal stenosis due to a broken uncovered metallic stent placed over 20 years ago in a patient with recurrent polychondritis using argon plasma coagulation and airway ballooning. *Respirology Case Reports.* 2024;12(9):e70034. <https://doi.org/10.1002/rcr2.70034>