Respiratory Medicine Extra (2007) 3, 168–171

ELSEVIER

respiratory MEDICINE Extra

CASE REPORT

Endobronchial argon plasma coagulation for neoplastic airway obstruction in a patient requiring supplemental oxygen, ventilatory and hemodynamic support

Nobuhiko Seki[a,*], Toshimori Tanigaki[a], Ryuzo Deguchi[b], Junko Nagata[b], Takashi Seto[a], Kazutsugu Uematsu[a], Kenji Eguchi[a]

[a]*Division of Pulmonary Medicine and Medical Oncology, Tokai University School of Medicine, Bohseidai Isehara, Kanagawa 259-1193, Japan*
[b]*Division of General Internal Medicine, Tokai University School of Medicine, Bohseidai Isehara, Kanagawa 259-1193, Japan*

Received 1 August 2007; accepted 3 September 2007

KEYWORDS
Argon plasma coagulation;
Neoplastic airway obstruction;
Critically ill patient

Summary
Reports on the safety and efficacy of endobronchial argon plasma coagulation (APC) for the treatment of neoplastic airway obstruction in critically ill patients are limited. We describe a case of severe airway stenosis in a patient with esophageal cancer who required high-inspired oxygen concentrations, mechanical ventilatory and hemodynamic support. Relief of obstruction was achieved with APC in the absence of bedside complications. APC can be performed safely for palliative management of obstruction due to endobronchial tumor even in critically ill patients in whom the use of the Nd-YAG laser is precluded.

Introduction

In patients with neoplastic airway obstruction, palliation may best be achieved by bronchoscopic intervention using laser photocoagulation, which results in immediate relief of the obstruction.[1] However, use of the Nd-YAG laser is precluded in patients with respiratory failure requiring high inspired oxygen (O_2) concentrations because of the risk of endobronchial combustion.[2,3] Recently, argon plasma

Abbreviations: APC, argon plasma coagulation; ABGA, arterial blood gas analysis; O_2, oxygen; SpO_2, pulse percutaneous oxyhemoglobin saturation.

*Corresponding author. Tel.: +81 463 93 1121x2210; fax: +81 463 93 0381.
E-mail address: seki@is.icc.u-tokai.ac.jp (N. Seki).

1744-9049/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.rmedx.2007.09.001

coagulation (APC), already widely used in gastrointestinal endoscopy,[4] has been adapted to flexible bronchoscopy.[5–10] Although, in comparison to the Nd-YAG laser, APC may require less operator skill and pose fewer hazards,[11] reports on its safety and effectiveness in critically ill patients are limited.[10] We report the successful treatment, using APC, of airway obstruction due to esophageal cancer in a mechanically ventilated patient requiring high inspiratory O_2 concentration and hemodynamic support in whom the use of Nd-YAG laser was precluded.

Case report

A 45-year-old woman was admitted to our hospital because of progressive dyspnea and weight loss of 6 months duration having been diagnosed with anorexia nervosa at her neighboring clinic. On examination temperature was 37.5%; heart rate, 126/min; respiratory rate, 40/min; and blood pressure, 68/32 mmHg. Breath sounds were decreased in both lower lung fields but except for relatively warm extremities the exam was otherwise unremarkable.

Laboratory studies included a white blood cell count of 14,600/mm^3 with 91% neutrophils. Hemoglobin level was 11.4 g/dl, and platelet count 315,000/mm^3. Serum albumin level was 2.8 g/dl. Arterial blood gas analysis (ABGA) with 10 L/min O_2 by non-rebreather reservoir facemask showed a pH 7.45, $PaCO_2$ 38 Torr, and PaO_2 68 Torr. Sputum culture grew *Klebsiella pneumoniae*. Chest radiography and computed tomography (CT) scan revealed stenosis of the distal left main bronchus, bilateral lower lobe pneumonia, and apparent esophageal thickening. She was felt to have septic shock secondary to severe bacterial pneumonia.

On the night of admission, her respiratory condition deteriorated requiring endotracheal intubation and mechanically assisted ventilation. Bronchoscopy was performed the next day for the purpose of bronchial toilet, when an endobronchial tumor arising from the left secondary carina was recognized obstructing 30% of the left lower lobe bronchus and 60% of the left upper lobe bronchus. Pathologic examination of biopsy specimens from both orifices revealed squamous cell carcinoma with hyperkeratinization below the bronchial epithelium, indicating direct bronchial involvement from esophageal cancer.

After initial improvement on antibiotics and vasopressors, her condition deteriorated on the 13th hospital day. Blood pressure was 98/40 mmHg with dopamine at 6 μg/kg/min and dobutamine at 12 μg/kg/min. ABGA on 70% supplemental O_2 showed a pH of 7.46, $PaCO_2$ 43 Torr, and PaO_2 78 Torr. Chest radiography revealed total atelectasis of the left upper lobe and volume reduction in the left lower lobe resulting in a leftward shift of the mediastinum (Figure 1A). Repeat bronchoscopy revealed almost total occlusion by tumor of the distal left main bronchus, which was not amenable to stenting (Figure 1B). Moreover ventilation with 70% O_2 precluded the use of Nd-YAG laser. We then decided to use endobronchial APC to establish patency of the occluded airways at her bedside.

The APC procedure was accomplished with the participation of 4 physicians and 1 nurse. One physician performed the bronchoscopy, while another ventilated the patient manually using a Jackson–Rees type anesthesia bag. A third administered medications including sedatives and vasopressors, and a fourth supervised and coordinated the procedure while the nurse assisted with preparation of equipment and medications. A thoracic surgeon was available if needed. Anesthesia and paralysis were achieved with IV Propofol and Vecuronium bromide. A Suction Safe® (Sontek Medical Inc.; Hingham, MA, USA) endotracheal tube was employed permitting passage of the bronchoscope with O_2 fed through a side orifice. EKG and pulse percutaneous oxyhemoglobin saturation (SpO_2) were monitored continuously. Blood pressure was measured at 5 min intervals. The tumor was electrocoagulated by an APC unit (APC 300 and ERBOTOM ICC 200; ERBE USA Inc.; Marietta, GA) with energy at 35 W and argon flow at 0.7 L/min through a 2.3-mm diameter APC monopolar probe via a flexible bronchoscope (model BF-1T200; Olympus Optical Co. Ltd., Tokyo, Japan), followed by debridement using forceps and suction. We stopped O_2 administration transiently, while APC was performed when the SpO_2 reached 99% to reduce the risk of endobronchial combustion. As the SpO_2 approached 90%, we interrupted the APC treatment and restarted O_2 administration. Interruption of the APC treatment was required frequently because of unstable oxygenation and blood pressure. These delays in addition to the time for SpO_2 to recover prolonged the procedure. Full patency of the left lower and upper lobe bronchi was achieved about in 4 h without any complication such as hemorrhage, perforation, or combustion. Most of the time was consumed achieving patency of the lower lobe bronchus after which oxygenation stabilized sufficiently to permit patency of the upper lobe bronchus to be achieved in only 1 h.

During the next 7 days, she was breathing spontaneously with 31% supplemental O_2 via tracheostomy. Her chest radiography revealed full expansion of both left upper and lower lobes without infiltrate (Figure 1C). On the 70th hospital day, however, she subsequently died of progression of her underlying disease and of recurrent obstructive pneumonia.

Discussion

APC is an innovative non-touch electrocoagulation technique in which a high-frequency alternating current is delivered to the tissue through ionized argon plasma. More recently, the applicability and relative safety of APC particularly in high-risk patients with central airway obstruction is being reported.[10] There are major advantages of APC treatment compared with Nd-YAG laser therapy.[11] Since the argon gas spreads conically in an axial as well as lateral direction, it can more easily access the target tissue. The penetration depth of 2–3 mm by APC is constant and predictable, thus limiting the thermal trauma. In contrast, the Nd-YAG laser requires more skill in controlling the power density and the direction of the light to avoid perforation and massive bleeding. The operator must take great care to avoid a complicating bronchial fistula. The risk of endobronchial combustion with APC is much lower than with the Nd-YAG laser.[2,3,10] Nonetheless, limitation of O_2 administration is advised. Maintaining the O_2 concentration at 40% or less, or intermittently reducing it to this level is recommended during instrumentation.[10] The operational simplicity