

Palliative Therapy with Argon Plasma Coagulation in Post-Intubation Tracheal Stenosis

Post-Entübasyon Trakeal Stenozda Argon Plasma Koagülasyonu ile Palyatif Tedavi

Aydan Mertoğlu, Yelda Vatanser, Günseli Balcı, Naime Taşdöğen, Rifat Özacar

Department of Chest Diseases, İzmir Chest Diseases and Thoracic Surgery Training and Research Hospital, İzmir, Turkey

ABSTRACT

Post-intubation tracheal stenosis is usually caused by pressure necrosis at the cuff. Although the best results are obtained by tracheal reconstruction, not all patients are able to undergo this operation for either medical or personal reasons. A 67-year-old male was admitted to our hospital with progressive dyspnea unrelieved by medical management. Bronchoscopy revealed stenosis of the trachea 2 cm below the vocal cord. In this case, as respiratory failure accompanied by COPD constituted a contraindication for tracheal surgery. It was decided to dilate the tracheal stenosis with APC. A 20-year-old female was admitted to our hospital with dyspnea and stridor. Bronchoscopy revealed a stenosis of the trachea 3 cm below the vocal cord. Because surgery was refused it was decided to dilate the tracheal stenosis with APC. APC has been successfully employed in the treatment of post-intubation tracheal stenosis in two surgery-refused and inoperable patients. The patients immediately experienced a relief of symptoms after APC. APC appears to be an effective alternative procedure for endobronchial dilatation in selected patients who are inoperable for either medical or personal reasons. (*Türk Toraks Derg* 2012; 13: 137-40)

Key words: Post-intubation tracheal stenosis, endobronchial treatment, APC

Received: 15.02.2010

Accepted: 07.06.2010

ÖZET

Post-entübasyon trakeal stenozlara genellikle endotrakeal tüp "cuf" larına ait basınç nekrozları neden olmaktadır. En iyi sonuçlar trakeal rekonstrüksiyon cerrahisi ile alınmasına rağmen, medikal ya da kişisel nedenlere bağlı olarak her olguda operasyon uygulanamamaktadır. Altmış yedi yaşında erkek hasta medikal tedaviye rağmen giderek artan nefes darlığı yakınması ile hastanemize başvurdu. Bronkoskopide trakeada vokal kordların 2 cm altında stenoz saptandı. Bu olguda KOAH'a bağlı solunum yetmezliği cerrahi için kontrendikasyon oluşturuyordu. Argon Plazma Koagülasyonu (APC) ile trakeal stenozun dilatasyonuna karar verildi. Yirmi yaşında genç kadın hasta nefes darlığı ve stridor ile hastanemize başvurdu. Bronkoskopide trakeada vokal kordların 3 cm altında stenoz saptandı. Cerrahi tedaviyi reddettiği için olguda APC ile trakeal dilatasyon kararı alındı. APC cerrahi tedaviyi reddeden ve klinik olarak inoperabl olan iki hastada başarılı palyasyon sağladı. Olguların işlemiden hemen sonra semptomlarında düzelme gözlemlendi. Seçilmiş olgularda APC endobronşial desobstrüksiyonu sağlayan etkin bir alternatif tedavi gibi görünmektedir. (*Türk Toraks Derg* 2012; 13: 137-40)

Anahtar sözcükler: Post entübasyon trakeal stenoz, endobronşial tedavi, APC

Geliş Tarihi: 15.02.2010

Kabul Tarihi: 07.06.2010

INTRODUCTION

Post-intubation tracheal stenoses are among the frequently encountered complications. The treatment of these stenoses occurring as a result of pressure-necrosis caused by endobronchial tubes is very difficult. Despite many advance in the use of both tubes and cuffs, these cases are still encountered [1-4]. Location, type and the length of stenosis are the factors affecting the choice and success of the therapy [5,6]. There is however no general agreement on the management of this disease. The primary choice of therapy in stenosis is the surgical treatment involving resection and reconstruction [1-3, 7-9]. As an important support and alternative therapy, endoscopic treatment of benign stenosis is used only when surgery was not possible due to clinical or technical reasons [5,6,10-14].

Endobronchial APC has recently been used widely in tracheobronchial disease because it allows rapid coagulation with minimal mechanical trauma to the target tissue. Although it has been proven effective for the treatment of malignant airway narrowing and post tracheal anastomosis, the use of this treatment for the post-intubation tracheal stenosis has not yet been reported [10,12,13,15,16].

We herein discuss the successful use of APC in the management of two patients with post-intubation tracheal stenosis.

CASE REPORTS

Case 1

A 67-year-old male was admitted to our hospital with progressive dyspnea and wheezing unrelieved by medical

management. He had been ventilated via an endotracheal tube for 7 days for severe respiratory failure secondary to COPD and a transitory tracheostomy was opened 4 months previously. Physical examination was remarkable for severe stridor, wheezing and tachypnea. Because the CT revealed a short-length lesion, it was decided to dilate the tracheal stenosis with APC using a flexible bronchoscope.

Conscious sedation with IV midazolam was administered before the procedure. Topical anaesthesia was achieved by endobronchial instillation of 2% lignocaine. Pulse oximetry, resting pulse and ECGs were monitored during bronchoscopy. Bronchoscopy revealed stenosis of the trachea 2 cm below the vocal cord (Figure 1). We performed several short bursts of APC at the sites of stenosis, and the devitalized tissue was then mechanically removed with grasping forceps.

The patient's respiratory distress and oxygen saturation both improved immediately after the process. An increase of 40 mmHg was established in the post-process partial arterial oxygen pressure and an evident clinic response was obtained. No complications associated with the process were observed. In the control bronchoscopy performed 1 week later, no change was seen. (Figure 2). No stenosis was observed during a two month-control.

Case 2

A 20-year-old female was admitted to our hospital with dyspnea and stridor unrelieved by medical management. She had been ventilated via an endotracheal tube for 7 days for respiratory failure secondary to pneumonia in intensive care unit 1 months previously. Because surgery was refused, it was decided to dilate the tracheal stenosis with APC using a rigid bronchoscope under general anesthesia. Bronchoscopy revealed a stenosis of the trachea 3 cm below the vocal cord (Figure 3). The stenosis opening process was carried out by APC and reached up to the carina by bronchoscopy after the process. Evident clinic response was obtained in the patient after the procedure. The enlargement occurred in the lumen was seen more clearly in the control bronchoscopy performed 1 week later (Figure 4). No stenosis was observed during a two month-control.

The equipment for APC consisted of the APC probe, an argon-gas source and a high-frequency surgical unit (APC 300, ERBOTOM ICC; Erbe Germany). To deliver the gas, a flexible monopolar teflon tube with a 1.5 mm diameter and 150 cm length was used; this was put into the working channel of the flexible bronchoscope. Energy at 30-40 W and argon flow at 0.5 L/min were then applied to the teflon tube. The stenotic lesion was endoscopically visualized and then coagulated at the site of the stenosis. The time it took to perform each coagulation was about 1-2 s, and coagulation was repeatedly performed at the stenotic site. Thereafter, the devitalized tissue was mechanically removed with grasping forceps.



Figure 1. At the FOB, approximately 2 cm after plica vocalis a stenosis which causes narrowing in the lumen at a rate of 80% was observed



Figure 2. In the control bronchoscopy performed 1 week later no progression was seen

One week and one month after the process, control bronchoscopy was performed.

DISCUSSION

The most frequent type of tracheal stenosis is due to iatrogenic events after tracheostomy or tracheal intubation. Post-intubation stenosis has been reported at a rate of 0.6-31% [1,8,17,18]. Approximately half of these cases have serious stenosis and develop respiratory failure [7,19,20]. Location, type and length of the stenosis are the factors affecting the choice and success of the therapy [5].

Tracheal stenosis represents an emerging problem that could be managed by less invasive procedures. The management of benign tracheal stenosis is controversial



Figure 3. Bronchoscopy revealed a stenosis which causes narrowing in the lumen at a rate of 85% was observed



Figure 4. The dilatation occurred in the lumen was seen in the control bronchoscopy performed 1 week later

and still not standardized or unified around the world. However, this clinical entity often requires interventional bronchoscopy before surgery is considered [21].

According to some authors, tracheal reconstruction surgery is the first choice of therapy for post-intubation tracheal stenosis. In selected cases where surgery can not be performed, therapeutic bronchoscopy should be considered as an alternative therapy [9-13,22]. Also there are studies that recommend performing therapeutic bronchoscopy first even though the patient is a candidate for surgery. It is reported that this will reduce the number of rings to be removed during resection [19, 21,23-25].

Brichet et al. [26] recommend sleeve resection if endobronchial treatment fails in web-like stenoses. The authors concluded that surgery is mandatory for the treatment of complex lesions and the interventional bronchoscopic procedures must be considered only in case of emergency to resolve acute respiratory failure for critical stenoses or for temporary management of the timing of surgery.

According to some authors, endobronchial treatment seem to be an appropriate treatment for the manage-

ment of post-intubation tracheal stenosis [5,10]. On the other hand, some authors experienced the endoscopic procedures as the first line of treatment obtaining different results [26,27].

Endobronchial therapy was successful in non-circumferential, medium-degree and less than 1 cm narrowing and surgery should be preferred in serious narrowing [1]. Galluccio et al. [5] shows that, after a correct classification, interventional endoscopy may have a crucial role in the treatment of tracheal stenoses and in particular, endoscopy should be considered the first choice for simple stenoses, whereas complex stenoses need a multidisciplinary approach and often require surgery.

Therapeutic bronchoscopic modalities include balloon dilatation, laser, APC, electrocauterization, cryotherapy, stent placement, endobronchial chemotherapy and brachiotherapy [28-31]. When therapeutic bronchoscopy is compared with surgical therapy it is more comfortable and less risky for the patients [6].

Balloon dilatation is a safe method that offers immediate symptomatic relief in both tracheal stenosis. However, this method is a temporary measure, as many patients will require definitive or additional treatment with laser or stent placement [32].

Topical application of Mitomycin C, a potent fibroblast inhibitor reduces granulation tissue formation and prevents recurrence. Some authors describe cases of tracheal stenosis managed by this endoscopic approach [28,31].

Studies emphasizing that curative therapy with bronchoscopy was performed only in one third of the cases [26], as well as those which have been successful in tracheal stenoses with APC and laser, are encountered in the literature [5,6,10,14].

Mehta et al. [27] have reported a 60% success rate after a few sessions of endobronchial laser therapy in diaphragm and web-like stenoses in selected cases.

Simpson et al. [9] mention the failure of the endoscopic laser therapies in serious tracheal stenoses if the stenotic area is wide and narrowing is circumferential and cartilage damage is present.

Recently, APC was used in the treatment of benign or malignant endobronchial lesions [12,13,15,16]. APC has an excellent safety profile, is convenient and simple to use, and is relatively low-cost. APC devitalizes tissue gradually by producing temperatures that coagulate and desiccate tissue. APC automatically seeks adjacent tissue with less electrical resistance. This can thus result in a homogenous but limited depth of penetration (approximately 3 mm). As a result, APC offers uniform coagulation and good protection against airway perforation [10].

Yasuo et al. [10] have reported that they have been successful and have not encountered any complications in medically inoperable cases with post-intubation stenosis, where they performed APC and subsequently mechanic cleaning, and they have no data on the risk of

restenosis. However, Brichet et al. [26] reported that three out of 15 patients with pinhole stenosis had to undergo alternative treatment at a later date following initial Nd-YAG laser dilatation.

We did not experience any crucial problems or restenosis during the treatment in our two cases.

We herein discuss the successful use of APC in the management of two patients with post-intubation tracheal stenosis. In our first case, respiratory failure and reduced respiratory function accompanied by COPD constituted a contraindication for tracheal surgery. The second case refused surgery. Then we decided to dilate the tracheal stenosis with APC. Both cases were relieved after the one-time process, their blood gas values improved and no restenosis was observed during a two-month control.

In conclusion, although tracheal reconstruction still remains the best treatment for postintubation tracheal stenosis, APC appears to be an effective alternative procedure for endotracheal dilatation in selected patients who are inoperable for either medical or personal reasons.

REFERENCES

1. Sarper A, Ayten A, Eser I, et al. Tracheal stenosis after tracheostomy or intubation: review with special regard to cause and management. *Tex Heart Inst J* 2005;32:154-8.
2. Anand V K, Alemar G, Warren E T. Surgical considerations in tracheal stenosis. *Laryngoscope* 1992;102:237-43. [CrossRef]
3. Couraud L, Jougon JB, Velly JF. Surgical treatment of non-tumoral stenoses of the upper airway. *Ann Thorac Surg* 1995;60:250-9. [CrossRef]
4. Maddaus MA, Toth JL, Gullane PJ, Pearson FG. Subglottic tracheal resection and synchronous laryngeal reconstruction. *J Thorac Cardiovasc Surg* 1992;104:1443-50.
5. Galluccio G, Lucantoni G, Battistoni P, et al. Interventional endoscopy in the management of benign tracheal stenoses: definitive treatment at long-term follow-up. *Eur J Cardiothorac Surg* 2009;35:429-33. [CrossRef]
6. Karakoca Y, Karaağaç G, Karakoca S, et al. Therapeutic bronchoscopic treatment of postintubation tracheal stenosis: 5 cases. *Tuberk Toraks* 2004;52:363-8.
7. Grillo HC, Donahue DM, Mathisen DJ, et al. Postintubation tracheal stenosis. Treatment and results. *J Thorac Cardiovasc Surg* 1995;109:486-92. [CrossRef]
8. Pearson FG, Andrews MJ. Detection and management of tracheal stenosis following cuffed tube tracheostomy. *Ann Thorac Surg* 1971;12:359-74. [CrossRef]
9. Simpson GT, Strong MS, Healy GB, et al. Predictive factors of success or failure in the endoscopic management of laryngeal and tracheal stenosis. *Ann Otol Rhinol Laryngol* 1982;91:384-8.
10. Yasuo M, Tanabe T, Tsushima K, et al. Endobronchial argon plasma coagulation for the management of post-intubation tracheal stenosis. *Respirology* 2006;11:659-62. [CrossRef]
11. Grund KE, Storek D, Farin G. Endoscopic argon plasma coagulation (APC) first clinical experiences in flexible endoscopy. *Endosc Surg Allied Technol* 1994;2:42-6.
12. Tremblay A, Marquette CH. Endobronchial electrocautery and argon plasma coagulation: a practical approach. *Can Respir J* 2004;11:305-10.
13. Sato M, Terada Y, Nakagawa T, et al. Successful use of argon plasma coagulation and tranilast to treat granulation tissue obstructing the airway after tracheal anastomosis. *Chest* 2000;118:1829-31. [CrossRef]
14. Cavaliere S, Bezzi M, Toninelli C, Foccoli P. Management of post-intubation tracheal stenoses using the endoscopic approach. *Monaldi Arch Chest Dis* 2007;67:73-80.
15. Morice RC, Ece T, Ece F, Keus L. Endobronchial argon plasma coagulation for treatment of hemoptysis and neoplastic airway obstruction. *Chest* 2001;119:781-7. [CrossRef]
16. Keller CA, Hinerman R, Singh A, Alvarez F. The use of endoscopic argon plasma coagulation in airway complications after solid organ transplantation. *Chest* 2001;119:1968-75. [CrossRef]
17. Andrews M J. The incidence and pathogenesis of tracheal injury following tracheostomy with cuffed tube and assisted ventilation. Analysis of 3 year prospective study. *Br J Surg* 1971;58:749-55. [CrossRef]
18. Whited RE. A prospective study of laryngotracheal sequelae in long term intubation. *Laryngoscope* 1984; 94:367-77. [CrossRef]
19. Grillo HC, Donahue DM. Post intubation tracheal stenosis. *Semin Thorac Cardiovasc Surg* 1996;8:370-80.
20. Noppen M, Schlessler M, Meysman M, et al. Bronchoscopic balloon dilatation in the combined management of postintubation stenosis of the trachea in adults. *Chest* 1997;112:1136-40. [CrossRef]
21. Zias N, Chroniou A, Tabba MK, et al. Post tracheostomy and post intubation tracheal stenosis: Report of 31 cases and review of the literature. *BMC Pulm Med* 2008;8:18. [CrossRef]
22. Marel M, Pekarek Z, Spasova I, et al. Management of benign stenoses of the large airways in the university hospital in Prague, Czech Republic, in 1998-2003. *Respiration* 2005;72:622-8.
23. Freitag L, Eicker K, Donovan JT. Mechanical properties of airway stent. *Journal of Bronchology* 1995;2:270-8.24. Unger M. Tracheobronchial stents, stunts and medical ethics revisited. *Chest* 1996;110:1133-5.
25. Freitag L. Flexible versus rigid bronchoscopic placement of tracheobronchial prostheses pro flexible bronchoscopy. *Journal of Bronchology* 1995;2:245-51. [CrossRef]
26. Brichet A, Verkindre C, Dupont J, et al. Multidisciplinary approach to management of postintubation tracheal stenoses. *Eur Respir J* 1999;13:888-93. [CrossRef]
27. Mehta AC, Lee FY, Cordasco EM, et al. Concentric tracheal and subglottic stenosis. Management using the Nd-YAG laser for mucosal sparing followed by gentle dilatation. *Chest* 1993;104:673-7. [CrossRef]
28. Wong JL, Tie ST, Samril B, et al. Successful treatment of tracheal stenosis by rigid bronchoscopy and topical mitomycin C: a case report. *Cases J* 2010;3:2. [CrossRef]
29. Rahman N A, Fruchter O, Shitrit D, et al. Flexible bronchoscopic management of benign tracheal stenosis: long term follow-up of 115 patients. *J Cardiothorac Surg* 2010;5:2. [CrossRef]
30. Krinsky WS, Rodrigues MP, Malayaman N, Sarkar S. Spray cryotherapy for the treatment of glottic and subglottic stenosis. *Laryngoscope* 2010;120:473-7. [CrossRef]
31. Ferreira S, Nogueira C, Oliveira A, et al. Bronchoscopic dilation techniques and topical application of mitomycin-C in the treatment of tracheal stenosis post intubation - two case reports. *Rev Port Pneumol* 2010;16:149-56.
32. Shitrit D, Kuchuk M, Zismanov V, et al. Bronchoscopic balloon dilatation of tracheobronchial stenosis: long-term follow-up. *Eur J Cardiothorac Surg* 2010;38:198-202. [CrossRef]