

# Case Report

## Treatment of bronchial stenosis after lung transplantation using a self-expanding metal endobronchial stent\*

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Although the incidence of complications resulting from the bronchial anastomosis employed in lung transplantation has decreased in recent years, it remains a significant cause of morbidity and mortality in these patients. Treatment options include balloon dilatation, laser photocoagulation, placement of a stent (silicone or metal), and performing a second operation. We report the case of a patient who presented bronchial stenosis after left lung transplantation and was treated with a self-expanding metal alloy (nitinol) stent (Ultraflex®). Despite the fact that this was the first case of stenosis treated in this fashion in Brazil, the positive clinical response, in agreement with results reported in the literature, indicates that this treatment is a viable alternative in such cases.

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### INTRODUCTION

Complications resulting from bronchial anastomosis still constitute one of the principal factors of increased morbidity and mortality among lung transplant patients. It is estimated that such complications occur in 27% of patients submitted to lung transplant, and that 13% of these patients require invasive bronchoscopy for the treatment of these

complications<sup>(1,2)</sup>. Although some centers have experience in the utilization of self-expanding stents, there is no data regarding their use in Brazil. Herein, we report the case of a patient who developed bronchial stenosis after lung transplantation and was treated with a self-expanding metal endobronchial stent.

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## CASE REPORT

A 57-year-old male ex-smoker was diagnosed with severe pulmonary emphysema. He presented progressive worsening for two years, to the point of having required hospitalization and mechanical ventilation. Since then, he made continuous use of supplementary oxygen, presenting dyspnea upon exertion and productive cough, mainly in the morning. He had long been making use of prednisone (30 mg/day) and had lost weight, with body mass index of 16.7. Spirometry presented mean forced expiratory volume in one second of 0.59 L (18% of predicted) and forced vital capacity of 1.88 L (46%). A blood gas test was performed with a catheter of O<sub>2</sub> at 2 L/min with PaO<sub>2</sub> of 138 mmHg and PaCO<sub>2</sub> of 85 mmHg. A quantitative perfusion lung scintigraphy presented 35% perfusion in the left lung.

After being submitted to the routine evaluation protocol, the patient was put on a waiting list and was later submitted to left lung transplantation.

The donor was a 38-year-old type B blood male patient, victim of a hemorrhagic cerebrovascular accident. The transplant was performed through a left posterior lateral thoracotomy with bronchial anastomosis using telescope technique, utilizing nonabsorbent propylene 4-0 sutures. Total ischemia time was three hours.

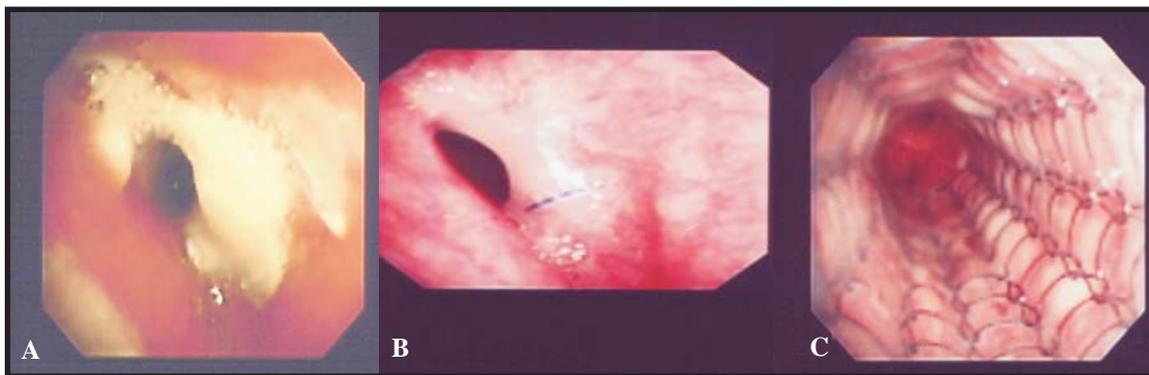
The patient presented uneventful postoperative evolution, with an episode of acute grade II rejection treated with methylprednisolone. On postoperative day 15, bronchial anastomosis evidenced enanthematous reaction and deposition of fibrin (Figure 1) without clinical repercussion, and the

patient was discharged on postoperative day 30. Outpatient fiberoptic bronchoscopy showed anastomosis retraction with decrease of its lumen. Three months after surgery the patient developed cough, dyspnea upon exertion and wheezing in the left hemithorax. A second fiberoptic bronchoscopy showed concentric stenosis of approximately 4 mm in diameter (Figure 1), and spirometry revealed forced expiratory volume in one second of 0.9 L (32% of predicted) and forced vital capacity of 2.73 L (79% of predicted), presenting a flow-volume curve consistent with upper-airway obstruction.

Dilatation of stenosis with a CRE 12-mm balloon (Boston Scientific, San Jose, CA, USA) was initially chosen, with significant improvement of symptoms. However, there was recurrence of cough and dyspnea after three weeks. At that point, it was decided that rigid bronchoscopy should be used. This was performed with the aid of fluoroscopy, dilatation with a CRE 15-mm balloon and treatment with a self-expanding, 14 x 40 mm metallic alloy (nitinol) endobronchial stent (Ultraflex Boston Scientific) (Figure 2). There was immediate improvement of symptoms and a 95% increase in the forced expiratory volume in one second (Figure 3). Four months after this procedure, the patient was breathing normally, and the bronchoscopic findings stabilized, without local complications.

## DISCUSSION

During the twenty years between the first lung transplantation performed by James Hardy in 1963 and the first success by the Toronto Lung Transplant Group in 1983, approximately 40 unsuccessful



**Figure 1.** A: Bronchial anastomosis with intense inflammatory reaction and deposition of fibrin two weeks after transplantation. B: Progression to fibrous cicatricial stenosis after 4 months. C: Final aspect after placement of stent

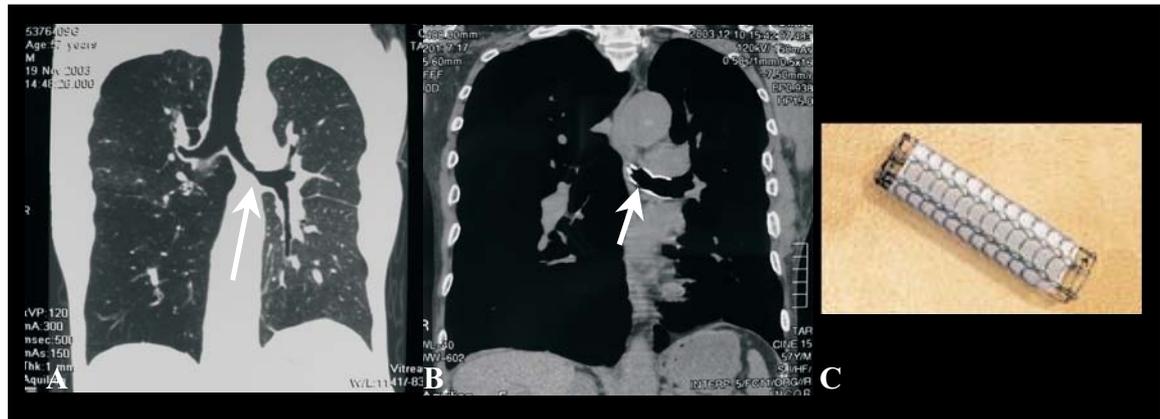


Figure 2. A: Multislice computed tomography revealing stenosis from anastomosis (arrow). B: Tomographic reconstruction after placement of stent (arrow). C: Aspect of sheathed stent (Ultraflex®)

transplantations were performed. The unfavorable outcomes were mainly related to poor healing of the bronchial anastomosis<sup>(3)</sup>. This resulted from bronchial ischemia since bronchial circulation is not re-established during the transplantation. Although anastomosis of the bronchial arteries have been defended by some authors, it has been found technically difficult and inefficacious<sup>(4)</sup>. Some techniques, such as the use of the short bronchial stump from the donor, use of the omentum or pedicle of intercostal muscle and invagination were found effective in reducing problems related to bronchial anastomosis.

Despite all precautions taken, airways complications are still common and are characterized either by obstruction due to fibrosis (stenosis) or dynamic obstruction (bronchomalacia). Therapeutic options for correcting these complications include endoscopic balloon dilatation, laser photocoagulation, placement of a silicone or self-expanding metal stent and performing a second operation. Burns et al.<sup>(5)</sup> consider balloon dilatation a merely palliative treatment, with immediate and transitory improvement of symptoms. In their study, all the patients submitted to dilatation required stent placement. However, Chhajer et al.<sup>(6)</sup> observed that 26% of the patients with stenosis after transplantation required no treatment other than dilatation, considering this to be always the first option since it allows assessment of the extension of the lesion, grade of inflammation and analysis of the bronchial tree in addition to stenosis. Although not efficient in resolving obstructions resulting from bronchomalacia, laser treatment can be used in the thermal ablation of granulation tissue that might be causing bronchial obstruction. In addition, recurrence appears to be quite common, and we have no experience with the use of laser surgery in Brazil.

Initially, the Hood and Dumon type silicone stents were quite widely used. However, such stents had numerous drawbacks. They were difficult to place and maintain in the appropriate position. They also frequently became impregnated with secretion and their lumens were narrow in comparison with their external caliber, resulting in their eventual replacement by metal stents<sup>(7)</sup>.

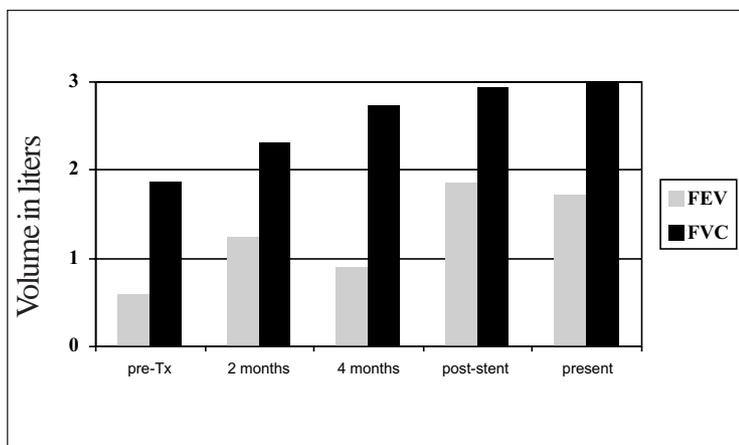


Figure 3. Forced expiratory volume in one second (FEV1) and forced vital capacity (FVC), revealing a slight increase after transplantation (Tx) and a sharp increase after placement of the Ultraflex®

There are four types of metal stents currently in use: the Palmaz Gianturco, Wallstent and Ultraflex. The first, a balloon-expandable stent, has no centrifugal radial force, allowing compression of its sleeve. In fact, using this stent, Lonchyna *et al.*<sup>(7)</sup> were forced to perform more interventions than when using the Wallstent stent (5.22 vs. 1.28 interventions). Burns *et al.*<sup>(5)</sup> observed complications in 36.7% of patients fitted with the Palmaz stent, compared with 10% of patients receiving the Wallstent.

The Gianturco stent, despite its small hooks designed to provide a better fit, may migrate, as was observed by Chhajed *et al.*<sup>(6)</sup> Due to its open mesh sleeve, it allows the growth of the respiratory epithelium, not interfering in the ciliary beat. It has no longitudinal elasticity, it is difficult to remove, and there are reports of fatal complications such as hemoptysis caused by vascular perforation. Nevertheless, Herrera *et al.*<sup>(8)</sup>, using only the Gianturco stent, reported no complications and obtained good results, with an immediate improvement in mean forced expiratory volume in one second of 87% (range, 50% to 290%).

The Wallstent and Ultraflex metal stents resist compression, feature uniform centrifugal radial force, and do not need hooks for their placement. They easily conform to the tortuosity of the airways, effectively maintaining a lumen. The complications related to these types of stents include difficulty of removal, formation of granulation tissue and retention of secretions. In the only existing comparative study, Chhajed *et al.*<sup>(2)</sup> analyzed the use of the Gianturco, Wallstent and Ultraflex stents retrospectively and obtained better results with the last, which presented a lower rate of restenosis (60%, 27% and 0%, respectively), less retention of secretions (0%, 27% and 0%, respectively) and a lower migration rate. They concluded that Ultraflex presents fewer long-term complications than do the other two stent models analyzed.

Since the number of lung transplantations performed in Brazil has increased, complications related to bronchial anastomosis, especially stenosis, have tended to become more common. Stent placement, albeit a palliative treatment, is the most often used due to the difficulties encountered in the second operations on these patients. The positive result obtained with this patient, together with the absence of complications, is in accordance with the few studies reported to date. Although this is the first reported case of the use of an Ultraflex stent in stenosis from bronchial anastomosis in Brazil, the favorable evolution of this patient indicates that its use may constitute a viable option for the treatment of this complication.

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