Tracheal replacement with an aortic autograft

Jacques F. Azorin a,*, Francois Bertin b, Emmanuel Martinod a, c, Marc Laskar b

a Thoracic and Vascular Unit, Avicenne Hospital, Bobigny, Paris XIII University, France
b Thoracic and Cardio-Vascular Unit, CHU Limoges, France
c Laboratoire d’Etude des Greffes et Prothèses Cardiaques, Hôpital Broussais, UPRES 264, Université Paris VI, France

Received 15 September 2005; received in revised form 17 November 2005; accepted 21 November 2005

Abstract

Tracheal replacement after extensive resection remains a challenge for the thoracic surgeon. We propose an innovative solution: the use of an aortic autograft. After an experimental work on animals with aortic autografts and allografts [Martinod E, Seguin A, Pfeuty K, Fornes P, Kambouchner M, Azorin JF, Carpentier AF. Long-term evaluation of the replacement of the trachea with an autologous aortic graft. Ann Thorac Surg 2003;75(5):1572—8; Martinod E, Seguin A, Holder-Espinasse M, Kambouchner M, Duterque-Coquillaud M, Azorin JF, Carpentier AF. Tracheal regeneration following tracheal replacement with an allogenic aorta. Ann Thorac Surg 2005;79(3):942—8], we present the first human case of long tracheal replacement with an aortic autograft. In this case we replaced 7 cm of a tumoral trachea using an aortic infra-renal autograft supported by a silicone stent. The early postoperative course was uneventful. The stent was removed at three months. The patient died at six months from an acute pulmonary infection without any sign of anastomosis leakage or graft rupture. A new field of clinical study has to be investigated.

Keywords: Trachea; Tracheal replacement; Aortic autograft; Aortic allograft; Primary tracheal tumor

1. Introduction

Most tracheal lesions can now be resected and primary reconstruction safely performed, as detailed in the review by Grillo [1]. The extent of safe resection can be of one-half of the tracheal length in adults and one-third in small children. Tracheal substitution can be needed to allow surgery of adenoid cystic carcinoma or primary tracheal tumors. Currently, these patients are managed palliatively with radiation, stents, and T tube. We propose an innovative solution: the use of an aortic autograft. To support this clinical strategy, preliminary studies were conducted in animal trials [2—5]. Following success in animals, we report here the first case of a long tracheal replacement with an aortic autograft on a human patient.

2. Patient and results

The patient was a 68-year-old man who presented with a squamous cell carcinoma of the trachea revealed in February 2004 by hemoptysis. We noted a previous history of myocardial infarction in 1987, peripheral arterial disease, and chronic obstructive pulmonary disease. The tumor was strictly limited to the trachea wall without any mediastinal or lymph node extension (Fig. 1). No distant metastasis was found. Laser treatment had been employed repetitively but the tumor kept recurring. This case was discussed at a multidisciplinary tumor board and a surgical resection followed by radiation therapy was decided. The tracheal tumor exceeded 7 cm in length and therefore resection followed by primary anastomosis was not possible. The patient accepted the replacement of his trachea using his own aorta and signed an informed consent. Because of persisting hemoptysis and the necessity to maintain anti-platelet therapy, preoperative chemotherapy was not retained. The patient was operated as soon as possible on June 8, 2004 by a thoracic and vascular team at the Academic Hospital of Limoges. Since this first case, two more cases have been performed at the Academic Hospital of Lille, with the agreement of the National Ethics Committee.

3. Surgical technique

The first step consisted in harvesting 7 cm of the abdominal aorta and its replacement by a Dacron® graft. The second step was the resection of 8 cm of the tumoral trachea beginning just below the cricoid cartilage and its replacement by the prepared atherosclerotic aortic graft.

* Corresponding author. Tel.: +33 1 48955230/31; fax: +33 1 48955232.
E-mail address: jacques.azorin@avc.aphp.fr (J.F. Azorin).

1010-7940/S — see front matter © 2005 Elsevier B.V. All rights reserved.
doi:10.1016/j.ejcts.2005.11.026
The limits of the resection had been estimated by a preoperative endoscopy. The pathologic analysis showed a circumferential squamous cell carcinoma. The distal section had a 5 mm free margin. The proximal section was just at the limit of the tumor. There was no carcinomatous invasion out of the trachea. Then, a silicone Dumon stent was introduced in the aortic graft through the operative field after the removal of the small silicone protrusions to avoid an injury of the aortic wall. Immediate postoperative course was uneventful. The patient was extubated 12 h after the end of the operation. Fifteen days later, a 30-gray external beam radiation was delivered to the whole trachea. Then, the patient was transferred to a special pneumologic convalescence center nearby Limoges. On 15th July, he presented an acute respiratory distress syndrome due to granulation tissue at the proximal anastomosis and this was treated by introducing an additional tracheal stent proximally. No late postoperative complications were noted following the placement of the new stent. The patient went back home on July 23, 2004 and was able to live normally. On 18th August, he was in good condition. At the beginning of September, during a postoperative visit, it was decided to pull out the stent, three months after its introduction, because it had migrated down to the carina and was causing acute episodes of cough and dyspnea. Bronchoscopic examinations in October and November did not show any collapse of the aortic wall. The two anastomoses were perfectly healed without granulomatous formations; the aortic surface was smooth and regular without any aspect of necrosis (Fig. 2). At the beginning of December, the patient presented an acute respiratory distress syndrome with a pneumonia and a controlateral pneumothorax treated in intensive care unit. Bronchoscopy showed no leakage of the anastomosis or perforation of the aortic wall. After this episode, he developed a bilateral pneumonia and died few days later of septic shock. The family did not consent to an autopsy and therefore the transplanted neo-trachea could not be analyzed.

4. Discussion

In a review of the literature, Grillo [1] discussed the need of tracheal replacement and the many efforts over the past century to accomplish this goal experimentally and clinically [6,7]. Our experience in vascular surgery, and the use of aortic allograft for replacement of infra renal aortic graft infection inspired us to use aortic autografts or allografts. The main advantages of this substitute are the resistance to infection, the absence of antigenicity and needs of revascularization, and also its diameter, its solidity, and its elasticity. On the other hand, the main inconvenient is its collapsing tendency. The use of an aortic allograft could avoid the morbidity of the aortic autograft harvesting. In our patient, we presumed that the Dumon stent with the small silicone protrusions removed had a migrating tendency and was most probably removed too soon. The iterative pneumonia and the respiratory distress syndrome after a pneumothorax could be explained by the difficulty to expectorate for a patient who presented a severe COPD. The bronchoscopic routine controls did not show evidence of collapsing airway. The radiotherapy perhaps induced a mediastinal fibrosis which reinforced the stiffness of the airway. Unfortunately we were not able to examine the neotrachea for further analysis. Nevertheless, we consider that our patient had a relatively prolonged survival after replacement of the thoracic trachea with an aortic autograft without any sign of necrosis or anastomosis leakage at six months.

5. Conclusion

Long tracheal replacement remains one of the big challenges in thoracic surgery. Aortic autograft and allograft in experimental works give us the hope that it can be a promising substitute. Clinical indications, however, remain rare making subsequently the human evaluation difficult.
References