

Larynx Transplant: A Therapeutic Option for the 21st Century? Literature Review

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The time and space devoted recently in the mass media to the transplantation of non-vital organs, such as the hands or the face, have raised questions in our patients regarding the possibility of transplanting the larynx, an essential organ for communication. The main barriers to larynx transplantation are tissue viability of the transplanted organ, immunological tolerance, and functional restoration. This review of the literature aims to update the compendium of knowledge about this procedure and to explore the prospects of larynx transplantation as a viable therapeutic option.

Key words: Larynx transplantation. Total laryngectomy. Reinnervation. Immune tolerance.

Transplante de la laringe: ¿una opción terapéutica para el siglo XXI? Revisión de la literatura

La presencia en los medios de comunicación del trasplante de órganos no vitales como las extremidades o la cara ha despertado el interés de nuestros pacientes, por la posibilidad de llevar a cabo el trasplante de un órgano tan trascendente para la comunicación como es la laringe. Los principales problemas que considerar para realizar un trasplante de la laringe son la viabilidad del órgano trasplantado, la tolerancia inmunológica y la capacidad funcional. A partir de la revisión de los estudios publicados, el presente trabajo pretende llevar a cabo una actualización de los conocimientos acumulados en relación con el trasplante laríngeo, así como explorar la posibilidad de que en un futuro este procedimiento pueda llegar a ser una opción terapéutica factible.

Palabras clave: Trasplante de laringe. Laringectomía total. Reinnervación. Inmunotolerancia.

INTRODUCTION

The presence in the media of successful hand or face transplants in our immediate environment has aroused interest about the technical possibilities and ethical considerations of non-vital organ transplantation. At present, it is not unusual for some of our patients to request information regarding the possibility of carrying out the transplant of "noble" structures of the head and neck region, such as the tongue, jaw and, above all, larynx.

Developments in recent years in the field of immunosuppression, knowledge of the neuroanatomy and neurobiology of the larynx and techniques for preservation

and transplantation of tissues make the transplantation of an organ as complex as the larynx a real possibility in the not too distant future. According to Genden et al,¹ instead of classifying candidate organs for transplant as "vital" or "non-vital," at present it would be more appropriate to consider them "essential" or "non-essential." In this respect, having a laryngeal voice and naso-oral ventilation would not be vital, but might be regarded as essential for a full quality of life.

At the time of raising the possibility of a larynx transplant, there are 3 key elements to consider: obtaining an adequate preservation of the larynx from the donor, its implantation and revascularization in the recipient; preventing rejection; and obtaining a functioning larynx. Equally important is to clarify those cases in which such a treatment would be indicated, taking into account the ethical considerations involved in a complex procedure, with risk of complications and that is not essential for survival.

The objective of the present review is to summarize published studies related to the realization of laryngeal transplant, analyze the experience gained on this issue, and assess future prospects for laryngeal transplantation as a treatment option.

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MATERIAL AND METHOD

In preparing this study we have carried out a review of papers published in connection with the transplantation of the larynx. We reviewed the articles identified from a MEDLINE search using transplantation and larynx as key words, as well as related articles selected from the bibliography in the works consulted.

DEFINITIONS AND CLASSIFICATION

A transplant is defined as the procedure by which an organ or tissue from a donor is implanted in a recipient. According to the genetic relationship between donor and recipient, they are classified as autotransplants when the patient serves as donor and recipient, isotransplants when the organ is transplanted between genetically identical individuals, allotransplants when the organ is transplanted between individuals who are not genetically identical, and, finally, xenotransplantation when the organ used comes from a donor of a different species to the recipient.

Depending on the physical location of the transplant, we can talk about orthotopic transplant when the transplanted organ occupies the same site of the damaged

organ, and heterotopic transplant when it occupies a different location.

THE CLEVELAND PATIENT

The first element to consider is the definition of laryngeal transplant. A transplant is considered as a full transfer of the organ with a vascular and nervous connection of the transplanted organ to the recipient patient. Previous cases such as reported by Kluyskens et al² in 1970 of the transfer of laryngeal tissue on the perichondrium of the recipient without revascularization should be considered as attempts at laryngeal repair with cartilage-mucosa grafts, and not as true transplants.

The first case reported in the medical literature of a complete laryngeal transplant and with appropriate monitoring was done by the team led by Dr Marshall Strome³ in the Cleveland Clinic Foundation (Philadelphia, USA) on January 4, 1998. In 2001, the authors published a detailed description of the procedure and the first 40 months of follow-up.⁴

The patient was a 40-year-old man named Timothy Heidler, who at age 20 had suffered a traffic accident as a result of which he suffered a fractured and healed larynx, with complete obstruction of air passage, completely fixed arytenoids and fragmented cricoids. The patient had been subjected to several unsuccessful reconstruction attempts, which required a tracheotomy for ventilation and the use of a laryngophone for verbal communication. A man of 40 with complete compatibility in the major histocompatibility complex system (HLA), who had died as a result of the rupture of a brain aneurysm and had been intubated less than 48 hours before dying, was chosen as donor.

The larynx-hypopharynx of the donor was excised, including 6 tracheal rings and thyroid, and parathyroid glands, along with the upper vascular thyroid pedicles, middle thyroid veins draining to the internal jugular vein, and internal and recurrent laryngeal nerves (Figure 1). The larynx was preserved in ice and Wisconsin University solution, until its implantation 10 hours after harvesting of the donor organ.

The transplant procedure was initiated by the vascular microsuture of the upper right thyroid artery of the donor to the equivalent of the recipient, and the proximal end of the inner right jugular vein of the donor to the right Farabeuf trunk of the recipient, covering the distal end of the inner jugular vein of the donor. After verifying an adequate perfusion of the transplant, a narrow field laryngectomy was conducted, preserving the recipient hyoid. Next, the transplanted organ was placed, for which three quarters of the donor hypopharynx were included, sutured to the hypopharynx mucosa of the recipient, the thyroid cartilage from the donor was joined to the host hyoid with reabsorbable sutures, and the donor trachea was anastomosed to the recipient, creating a new tracheal stoma on the donor trachea. The vascular sutures on the left side were complemented with anastomosis of the upper thyroid artery of the donor to the recipient's equivalent, and the

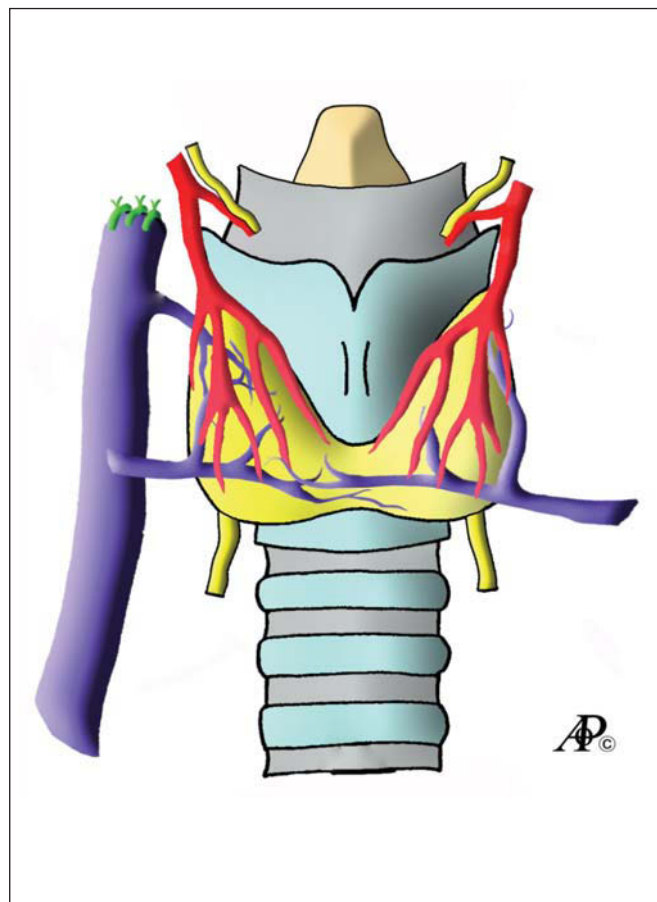


Figure 1. Laryngeal block obtained from the donor (modified from Strome et al⁴).

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