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BRIEF COMMUNICATION

Total voice prosthesis incarceration in the trachaeo-oesophageal mucosa. Report of a new complication when using phonatory prostheses

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KEYWORDS Phonatory prosthesis; Provox; Complications; Granulation tissue

Abstract

We report the cases of three patients seen at the Otolaryngology Department after presenting a laryngeal carcinoma that required total laryngectomy, followed by tracheo-oesophageal puncture and Provox voice prosthesis positioning. In all cases, the growth of granulomatous tissue totally incarcerated the prosthesis in the tracheo-oesophageal mucosa. In two of the cases, the prosthesis could be extracted by oesophagoscopy and a new prosthesis positioned in the same surgery. In the third case, an external approach was performed using a peristomal incision to extract the prosthesis. A new tracheo-oesophageal puncture was then performed 3 months after the extraction.

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PALABRAS CLAVE

Prótesis fonatoria; Provox; Complicaciones; Tejido de granulación

Incarceración total de prótesis fonatoria en la mucosa traqueoesofágica. Informe de una nueva complicación con el uso de prótesis fonatorias

Resumen

Presentamos los casos de 3 pacientes atendidos en el Servicio de Otorrinolaringología de nuestro centro por haber presentado un carcinoma epidermoide de laringe que requirió laringectomía total. Se les realizó fistuloplastia primaria y colocación de prótesis fonatoria Provox. En estos 3 casos se produjo un crecimiento de tejido granulomatoso alrededor de la fístula, que acabó por enterrar completamente la prótesis fonatoria en la mucosa traqueoesofágica. En dos de los ca-

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sos fue posible la extracción de la prótesis mediante esofagoscopia rígida. En el otro caso, se precisó la realización de un abordaje externo mediante incisión periestomal para lograr la extracción de la prótesis. En los pacientes en que se pudo extraer la prótesis se recolocó una nueva en el acto. En el otro caso, se esperó a la completa cicatrización del tejido para realizar una fistuloplastia secundaria a los 3 meses de la intervención.

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Introduction

The treatment of the sequelae from laryngeal voice loss after radical surgical treatment with total laryngectomy changed dramatically with the advent of surgical techniques for obtaining pulmonary voice. Given the high rate of complicationsderivedfromthesetechniques(mainlyaspiration of pharyngeal contents into the airways), mechanical valve devices inserted into the tracheo-oesophageal mucosa began to be used with the aim of obtaining an acceptable voice in as many patients as possible and also to prevent the passage of saliva and food into the airway.¹⁻³

The use of voice prostheses has extended to the vast majority of ENT services in the world and surgical technique results have been published, as well as the characteristics of the voice with prosthesis, 4 the advantages over erygmophonic voice and possible complications.^{5,6} The complications of the prosthesis include those which involve and are resolved with a change thereof and also complications of the surgical technique or of prosthesis mobilisation. It is recognized that those involving a change of prosthesis are, in order of frequency, incompetence of the valve or the surgical fistula, the deterioration of the prosthesis due to fungal colonisation, the emergence of mucoid crusts that impede a correct functioning and granulomas in the fistular path or tracheal mucosa. Among the complications themselves are persistent fistula inadequate to prosthesis diameter, cervical cellulitis, necrosis of the tracheo-oesophageal mucosa, stomal stenosis and dysphagia. The aspiration of the prosthesis to the bronchial tree and its intake into the digestive system have also been described, along with the emergence of local abscesses or infectious mediastinitis associated to the tracheo-oesophageal puncture.7,8

The appearance of granulomas in the orifice of the fistula is between 5% and 10%, but we have found no publications to date detailing complete incarceration of the voice prosthesis within the tracheal mucosa as a complication, with a consequent loss of functionality and the need for a surgical approach to restore pulmonary voice, remaking a new fistula and placing a new prosthesis.

Our aim is to report a new long-term complication due to scar tissue or granulation with the use of voice prosthesis and to expose the surgical solution that was applied in each case.

Methods

We highlight the cases of three male patients who attended a scheduled review. All cases referred the impossibility of phonation through the phonatory fistula. In the three cases, direct examination of the tracheal stoma revealed the disappearance of the fistula with complete closure of the mucosa of the tracheo-oesophageal wall. In all cases, we carried out a study by simple chest radiograph, cervical radiography with soft tissue penetration and cervical computed tomography (CT), showing that the prosthesis was in its original position but covered by tracheal mucosa in its entirety.

In all cases, we scheduled surgery for the complication under general anaesthesia, firstly, to remove the incarcerated prosthesis and secondly, to perform a new tracheo-oesophageal fistula and restore pulmonary voice with voice prosthesis.

Results

Table shows the characteristics of the patients studied. This complication accounts for 1.58% of all patients with voice prosthesis treated in our centre.

In all the cases, we carried out primary fistuloplasty in the same surgery as total laryngectomy, after a diagnosis of squamous cell carcinoma. Only one patient received postoperative radiotherapy. The reason for consultation in all cases was the impossibility of pulmonary voice with the prosthesis; we also observed the disappearance of the prosthesis from the tracheal mucosa. In the chest x-ray, the voice prosthesis was identifiable despite the absence of a radiopaque contrast (Figure 1). The prosthesis was also readily identifiable in the cervical CT (Figure 2).

The complication appeared after 3, 7, and 10 years of the completion of the tracheo-oesophageal puncture and placement of the first prosthesis. Prosthesis changes were made with a periodicity that varied between 4 and 13 months in all cases.

In Cases 2 and 3, the incarcerated prosthesis was extracted through rigid oesophagoscopy, performing in the same surgery a new tracheo-oesophageal puncture through which a new voice prosthesis was placed, of a greater length.

In Case 1, extraction was not possible through rigid oesophagoscopy and an external approach had to be used, with semicircular "omega" incision in the upper region of the tracheal stoma. In this patient, we waited for the complete healing of the tissues adjacent to the tracheo-oesophageal junction, and subsequently carried out a new tracheooesophageal puncture and reattachment of prosthesis of a length immediately greater than the previously used.

Discussion

The introduction and widespread use of voice prostheses have represented the greatest progress in the rehabilitation

| Patient | Age/ gender | Initial treatment | Time to complication | Treatment for the complication | Results | Posterior prosthesis use | Monitoring |
|---|-------------|----------------------|----------------------|--------------------------------------|-------------------------------|--------------------------------|------------|
| 1 | 62/ male | TL+BFCE | 37 months | Open surgery | Granular tissue recurrence | Yes. Provox 12.5 | 18 months |
| 2 | 55/ male | TL+BFCE+RT | 10 years | Oesopha- | | | |
| | | | and 2 months | goscopy | Good | Yes. | 8 mont hs |
| | | | | | | Provox 10 | |
| 3 | 58/ male | TL+BFCE | 7 years and | Oesopha- | Good | Yes. | |
| | | | 6 mont hs | goscopy | | Provox 10 | 6 mont hs |
| BECE indicates bilateral functional cervical emotying: BT radiotherapy: TL total larvngectomy | | | | | | | |

Table Characteristics of the patients included in the present study



Figure 1 Anteroposterior chest radiograph showing the existence of a Provox prosthesis in its original position (arrow).



Figure 2 Computed tomography scan showing the existence of a Provox prosthesis in its original position, but fully covered by the tracheal mucosa.

of communication skills in patients treated with total laryngectomy.¹⁻³ The results obtained through the use of these voice prostheses have been increasing steadily and currently reach over 70% effectiveness with the use of the Provox prost hesis.9,10

The Provox voice prosthesis is an effective device in voice rehabilitation of laryngectomized patients. It has outperformed its predecessors in patient tolerance and the maintenance of a pulmonary voice with low flows with respect to the Nidjam or Groningen prostheses, albeit with a higher incidence of granulation and scar tissue formation around the prosthesis.¹¹ The main advantage of the Provox 2 prosthesis is that it is possible to replace it in outpatient consultation; less than 3% of patients require general anaesthesia for this change. Its main disadvantage is the higher incidence of periprosthetic fistulas, probably due to the increased diameter of the fistuloplasty necessary to accommodate the Provox prosthesis as compared to other prost heses. 11, 12

Since the use of Provox voice prostheses became widespread, possible complications of their use and maintenance have been described. Endo- or periprosthetic leak of pharyngeal content to the airway is the most frequent in all the series, occasionally involving the removal of the prosthesis. Surgical techniques have been described for the resolution of periprosthetic leakage,¹³ since endoluminal leakage is usually solved by replacing the old prosthesis with a new one.

One of the most common complications is the development of granulation tissue around the voice prosthesis, which in most cases requires no treatment. However, when the prosthesis becomes buried, this should be corrected with resection or vaporisation of hypertrophic tissue, which can be done with silver nitrate or a KTP or CO2 laser.14 In our centre, we use carbon dioxide laser with a handheld device, defocusing the laser point until the hypertrophic tissue disappears completely. Granulation tissue appears in from 7\$ to 17.4% of voice prostheses carriers, 7,8,15 while the full incarceration of the prosthesis in the tracheal mucosa with closure had not been reported until now.

For diagnosing total incarceration of the voice prosthesis in the tracheo-oesophageal mucosa, a radiological control should be performed through an anteroposterior chest x-ray in which the prosthesis may be observed, despite the absence of a radiopaque contrast. Due to the overlap of the prosthesis with cervical bone structures, it may not be possible to recognise or identify the position of the

prosthesis; in such cases, a CT scan of the cervicothoracic junction should be obtained to ensure that the prosthesis has become incarcerated and has not mobilised to the bronchial tree. In cervical radiographs with soft tissue penetration, the prosthesis cannot be identified due to the technique required and to the overlap with numerous musculoskeletal structures.

The first choice for the treatment of voice prosthesis incarceration would be the removal of the prosthesis through oesophagoscopy and foreign body forceps, with subsequent placement of a new voice prosthesis of a length immediately greater than the previously used, after tracheo-oesophageal puncture (with endoscopic control). In cases where the extraction by oesophagoscopy is impossible due to difficulties in extraction or when it is suspected that this will be too traumatic, open surgery with "omega" incision in the upper part of the tracheal stoma should be used. This will enable faster, easier access to the tracheo-oesophageal space, through which the prosthesis can be separated from the tracheal mucosa for its removal. Subsequently, the oesophageal mucosa and surrounding tissues should be left to heal for a period of no less than three months, after which a new tracheooesophageal puncture can be carried out to place a new prosthesis, always of a length greater than that used previously.

Regarding the causes of incarceration, it does not seem that the need for radiotherapy or pre- or postoperative chemotherapy is a crucial factor, given that 2 of the 3 patients had received no additional treatment. Trudeau et al.¹⁶ and Artázkoz del Toro and López Martínez¹⁷ found a similar rate of success and complications in patients who had received radiotherapy and those who had not. The appearance of granulation tissue seems to be the main cause of prosthetic incarceration. As the only causal factor, Pattani et al.¹⁸ found an association between the existence of gastroesophageal reflux and the development of granulation tissue; they showed that the granulation tissue disappeared in 100% of patients who received aggressive antireflux therapy (proton pump inhibitors at maximum dose and postural and dietary measures), henceforth recommending antireflux treatment in patients with phonatory fistula as a preventive method. This theory coincides with the delayed appearance of granulation tissue and its progressive growth to long-term prosthesis burial in our patients. As a hypothesis, we can suppose that incorrect measurement by default of the size of the prosthesis to be used may also be the cause of incarceration, because the replacement by a longer prosthesis has solved the problem in our experience.

Conclusions

The appearance of granulation tissue in the path of a phonatory fistula is a common complication, but complete incarceration of a voice prosthesis within the tracheal mucosaisrare. The incarceration should be treated surgically through oesophagoscopy or, in isolated cases, through open surgery to enable access to the tracheo-oesophageal space. The occurrence of this complication may be related to the presence of gastroesophageal reflux or to an inadequate prosthesis size.

Conflict of interests

The authors declare no conflict of interests.

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