

Functional and epidemiological outcomes of swallowing in supratracheal laryngectomy with traqueohioidoepiglottopexy

Aspectos funcionais e epidemiológicos da deglutição na laringectomia supratraqueal extendida com traqueohioidoepiglottopexia

Resultados funcionales y epidemiológicos de la deglución en la laringectomía supratraqueal con tracheohioidoepiglottopexia

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Abstract

Introduction: Supratracheal partial laryngectomy (STPL) is a current alternative for surgical intervention, indicated for the treatment of intermediate / advanced laryngeal tumor. When its resection is

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Received: 11/06/2018

Accepted: 28/12/2018

broader than predicted by this technique, we add the term “extended” to its nomenclature. Its reconstruction is made, among variations, by traqueohioidoepiglottopexy (THEP). The main complications of this procedure are related to swallowing and breathing. **Objective:** To characterize the selected population and to evaluate functional aspects of swallowing in extended STPL by THEP reconstruction. **Method:** Observational cross-sectional study on patients of both sexes with laryngeal neoplasm submitted to extended STPL by THEP in a cancer hospital from 1995 to 2017. A study of the medical record, consultation on the surgical system, Videofluoroscopy Swallowing Study and application of the scale National Outcomes Measurement System of the American Speech-Language Hearing Association (ASHA NOMS) were made. **Results:** 10 men, aged between 52 and 83 years (median 69), 80% smokers and alcoholics at diagnosis; T2 [70%], T3 [30%]. Results of videofluoroscopy of swallowing: 100% stasis on tongue base, 80% on vallecula, arytenoid (s) and pyriform recess, 40% on upper esophageal sphincter and 30% on posterior wall of pharynx; 30% presented aspiration. All of them presented oral nutrition and hydration. **Conclusion:** Male patients, mostly elderly, alcoholics and smokers with intermediate and advanced tumor staging. All of them had nutrition and hydration capacity without alternative food routes. The swallowing function was satisfactorily restored with specialized speech therapy at all times of treatment. Patients with more than nine months of surgery had better functional results.

Keywords: Speech, Language and Hearing Sciences; Epidemiology; Laryngectomy; Deglutition.

Resumo

Introdução: A laringectomia parcial supratraqueal (LPST) é uma alternativa atual de intervenção cirúrgica, indicada para o tratamento de tumor laríngeo intermediário / avançado. Quando sua ressecção é mais ampla do que previsto, acrescentamos à nomenclatura o termo “extendida”. Sua reconstrução é feita por uma traqueohioidoepiglottopexia (THEP). As principais complicações conhecidas deste procedimento estão relacionadas à deglutição e respiração. **Objetivo:** Caracterizar a população selecionada e avaliar aspectos funcionais da deglutição na LPST extendida em reconstrução THEP. **Método:** Estudo observacional de corte transversal de pacientes de ambos os sexos com neoplasia de laringe submetidos à LPST extendida THEP de um hospital oncológico entre 1995 a 2017. Realizou-se estudo de prontuário, consulta ao sistema cirúrgico, videofluoroscopia da deglutição e aplicação da escala National Outcomes Measurement System da American Speech-Language Hearing Association (ASHA NOMS). **Resultados:** 10 homens, idade entre 52 e 83 anos (mediana 69), 80% tabagistas e etilistas ao diagnóstico; T2 [70%], T3 [30%]. Resultados da videofluoroscopia da deglutição: 100% de estase em base da língua, 80% em valécula, aritenóide(s) e recessos piriformes, 40% em esfíncter esofágico superior e 30% em parede posterior da faringe; 30% apresentou aspiração. Todos apresentaram alimentação e hidratação exclusiva por via oral. **Conclusão:** Indivíduos homens, majoritariamente idosos, etilistas e tabagistas com estadiamentos intermediários e avançados. Todos possuíam capacidade de nutrição e hidratação sem vias alternativas de alimentação. A função de deglutição foi satisfatoriamente restaurada com atendimento fonoaudiológico especializado em todos os momentos do tratamento. Os pacientes com mais de nove meses de cirurgia apresentaram melhores resultados funcionais.

Palavras-chave: Fonoaudiologia; Epidemiologia; Laringectomia; Deglutição.

Resumen

Introducción: La laringectomía parcial supratraqueal (LPST) es indicada para el tratamiento de tumor laríngeo intermedio / avanzado. Cuando su resección es más amplia de lo previsto por la técnica, añadimos a nomenclatura el término “extendida”. Su reconstrucción se realiza, entre variaciones, por traqueohioidoepiglottopexia (THEP). Las principales complicaciones conocidas de este procedimiento se relacionan con la deglución y la respiración. **Objetivo:** Caracterizar la población seleccionada y evaluar aspectos funcionales de la deglución en la LPST extendida en reconstrucción THEP. **Método:** Estudio observacional de corte transversal de pacientes de ambos sexos con neoplasia de laringe sometidos a LPST extendida THEP de un hospital oncológico entre 1995-2017. Se realizó estudio de prontuario, consulta al sistema quirúrgico, videofluoroscopia de deglución y aplicación de la escala National Outcomes

Measurement System da American Speech-Language Hearing Association (ASHA NOMS). **Resultados:** 10 hombres, edad entre 52 y 83 años (mediana 69), 80% tabaquistas y etilistas al diagnóstico; T2 [70%], T3 [30%]. Resultados de la videofluoroscopia de la deglución: 100% de estase en base de la lengua, 80% en valécula, ariteoide y recesos piriformes, 40% en esfínter esofágico superior y 30% en pared posterior de la faringe; El 30% presentó aspiración. Todos presentaron alimentación e hidratación exclusiva por vía oral. **Conclusión:** Individuos hombres, mayoritariamente ancianos, etilistas y tabaquistas con estadios intermedios y avanzados. Todos poseían capacidad de nutrición e hidratación sin vías alternativas de alimentación. La función de deglución fue satisfactoriamente restaurada con atención fonoaudiológica especializada en todos los momentos del tratamiento. Los pacientes con más de nueve meses de cirugía presentaron mejores resultados funcionales.

Palabras claves: Fonoaudiología; Epidemiología; Laringectomía; Deglución.

Introduction

According to the Brazilian Health Ministry, in the epidemiological, social and economic context, cancer is one of the most multifaceted adversities regarding the public health system¹. With a significant incidence in men aged 55-65 years of age, laryngeal squamous cell carcinoma represents 2% to 5% of all tumors diagnosed in the world². The different forms of treatment developed in the twentieth century have intensified care and significantly increased their combat. Nevertheless, an unfavorable outcome along with deficits in the functionality of the larynx still characterize a restricted prognosis of patients with the disease in its advanced stage; this is due to either loss or voice disorders as well as the existence of dysphagia, which, significantly, jeopardize the quality of life^{3,4}.

Organ preservation protocols query on the need for very advanced resections and total laryngectomies⁵. In this way, other means of treatment, such as chemotherapy and radiotherapy, are needed. However, in advanced stages, the sequelae of these techniques can be drastic and may result in the preservation of a nonfunctional organ with significant structural damage^{6,7}.

With the purpose of preserving the largest possible extension of the organ free of the disease, the conservative surgery for laryngeal carcinoma portrays the removal of the tumor in the safety margin. The surgery aims to control the disease and, when feasible, to recover the function of breathing, swallowing and voice production. Therefore, this method is not only based on the removal or maintenance of anatomical structures, but it also involves the reconstruction of a functional neolarynx⁴. Horizontal partial laryngectomies, in-

cluding supraglottic laryngectomies, supracricoid laryngectomies, and, more recently, supratracheal laryngectomies have been a viable surgical option for the treatment of laryngeal cancer in intermediate/advanced stages⁸.

Supracricoid partial laryngectomy (SCPL) was introduced by Majer and Rieder in 1959 and improved over the years as a viable option to total laryngectomy⁹. Supratracheal partial laryngectomy (STPL) is a current surgical procedure equivalent to Supracricoid partial laryngectomy (SCPL), an adaptation for the treatment of laryngeal tumors with subglottic extension and invasion of the intermediate/advanced stages of cricoid cartilage^{10,11}. This resection maintains, at least, one half of the functioning posterior cricoid plate with the arytenoid and the lower laryngeal nerve; they are all kept intact on the corresponding side (cricoaarytenoid unit). Consequently, this method allows the preservation of the main laryngeal functions without the use of a permanent tracheostoma¹¹.

The surgical technique, originally described in the literature, consists of resectioning the entire thyroid cartilage and the paraglottic space; preserving part of the cricoid cartilage and maintaining the hyoid bone; preserving the epiglottis or removing it; and preserving, at least, one arytenoid cartilage¹². The reconstruction is described with two variations: 1 - Tracheohyoidopexia (THP), in which both or only one cricoarytenoid unit is kept; 2 - Tracheohyoidoepiglottopexy (THEP), in which the resection provides for the preservation of the epiglottis, keeping all the cricoarytenoid unit or only one cricoarytenoid unit¹³.

The most recurrent functional complications of horizontal open partial laryngectomies are, in particular, the ones related to respiratory functions¹⁴ and swallowing; they show low incidence

of permanent postoperative tracheostomy¹⁵. In cases whose resection is broader than predicted by the technical description, as well as in cases of STPL (Supratracheal partial laryngectomy) already described, which remove part of the base of tongue, adjacent tissue or arytenoid, we call it Extended, Broadened or Modified STPL procedure^{16,17}. The bibliography approaching the functional results after speech-language pathology rehabilitation of patients who underwent the Extended STPL is scarce, prevailing surgical techniques and little deepening of swallowing¹⁸⁻²⁰.

The aim of the present study was to characterize the population who underwent the Extended STPL (Supratracheal partial laryngectomy) in THEP (Tracheohyoidoepiglottopexy) reconstruction and to evaluate its functional aspects regarding swallowing in a reference Oncology Hospital.

Method

This is a cross-sectional observational study to evaluate the functional disorders and the epidemiological aspects in patients submitted to the treatment of laryngeal neoplasms in Hospital do Câncer I (HCI) of the Instituto Nacional do Câncer (INCA), located in the city of Rio de Janeiro. Patients of both sexes were included; they were registered in the Head and Neck Surgery Section of the HCI/INCA from September 1995 to July 2017, diagnosed with laryngeal neoplasm and submitted to the Extended STPL in THEP (Tracheohyoidopexia) reconstruction.

This study was approved by the Ethics Committee in Research of the institution under number 26331314.2.0000.5274. Patients with active disease at the time of the evaluation; the ones aged less than 18 years; the ones who did not sign the Informed Consent Term; the ones who were not located, the ones who died; and those who underwent another surgical procedure in the laryngeal region after the Extended STPL were excluded.

For the mapping of clinical and sociodemographic aspects, a study of the medical records of each individual as well as a consultation of the surgical system of the pre-established period was carried out.

Videofluoroscopy of deglutition (VFD) was used for dynamic, objective and quantitative analysis of swallowing²¹. The examinations were performed with the SIEMENS Axiom Iconos

MD X-ray remote control device (Serial Number 13020), in the years 2016 - 2017 and analyzed according to the Videofluoroscopic Deglutition Evaluation protocol, based upon Logemann (1998)²². All video segments were recorded in a side view plan with an image capture rate of 30 frames per second and it was saved in Picture Archiving and Communication System (PACS) for a later review and analysis. The material accumulated in different regions of the pharynx after the end of swallowing was considered stasis²².

The preparation of consistencies and the offer of them were performed as described below: the contrast was offered in a glass using dilutions of Barium Sulphate (BaSO₄) to 100% of Bariogel®, Mineral Water and Resource® Thicken Up Clear. The evaluation was composed of three consistencies, they are: 1) liquid in 5ml (2.5ml of water + 2.5ml of BaSO₄), 10ml (5ml of water + 5ml of BaSO₄) and 20ml (10ml of water + 10ml of BaSO₄); [2] semi liquid in 5ml of BaSO₄, 10ml of BaSO₄ and 20ml of BaSO₄; [3] and paste in 5ml (5ml of BaSO₄ + 1.2g of Thickener), 10ml (10ml of BaSO₄ + 2.4g of Thickener) and 20ml (20ml of BaSO₄ + 3.6g of Thickener). In order to standardize the test, due to the existence of edentulous individuals, food in solid consistency was not included. The individuals were placed seated in lateral view, positioned as close as possible to the table top and the intensifier, in this manner, distortions of the fluoroscopic image were avoided.

The National Outcomes Measurement System of the American Speech-Language Hearing Association (ASHA NOMS) scale was used as a subjective and complementary means of analysis of oral ingestion, since it is widely accepted in the evaluation of oropharyngeal dysphagia and is based on clinical observation, whose scores range from 1 (less functional) to 7 (normal). The scale is usually employed as a guide to the suitable nutritional strategy at the time of evaluation; however, it does not represent an objective and quantitative tool of the symptom. It allows to understand the individual's ability to eat independently and the limitations in the swallowing function, the changes in consistency and/or the insertion of compensatory strategies when needed²³.

Results

We found 13 patients with Extended Supratracheal Laryngectomy in THEP reconstruction. Out of these, three were excluded from the study according to established criteria: (1) death from metastasis of cervical squamous cell carcinoma and prostate tumor, (1) second laryngeal primary tumor and cerebral metastasis, and (1) total laryngectomy due to upper esophageal impairment.

All 10 patients evaluated were male. Their age ranged from 52 to 83 years of age, with an average of 68 years (± 8.04 years) and a median of 69 years. Eight patients reported being smokers and alcoholics at diagnosis. Half of the individuals reported a family history of cancer and 90% presented a histological type of laryngeal squamous cell carcinoma. As for tumor size, 70% were T2 and 30% T3, all stages being intermediate and advanced. One patient required a permanent tracheostomy (Table 1) and no one needed the use of alternative feeding techniques (average length of stay 44.9 days ± 28.02 days). The average time after Extended STPL with THEP reconstruction was 25.8 months (± 29 months) and median of 9 months, ranging from 5 to 90 months.

Videofluoroscopic findings revealed that only three patients showed aspiration at the time of evaluation. As for the presence of stasis, all patients had stasis on the base of tongue; eight had it in vallecula, arytenoid(s) and pyriform recesses; four had it in the upper esophageal sphincter; and three had it in the posterior pharyngeal wall (Table 2). All who had aspiration during the evaluation were older than 65 years of age and had stasis in almost all the evaluated regions. Out of these three, 67% (N = 2) reported a family history of cancer.

The results found on the ASHA NOMS scale suggest that all the patients in this study were exclusively in oral nutrition and hydration. Fifty percent (50%) were classified at level 7; twenty percent (20%) at level 6; twenty (20%) at level 5; and ten

(10%) at level 4. Consequently, only one patient required compensatory strategies and/or moderate dietary restrictions (consistency manipulation). All individuals clinically showed safe swallowing without alternative feeding means. No patient had a history of pneumonia.

Table 1. Distribution of Clinical and Demographic Features.

Clinical Variables	Patients (n=10) n(%)
Sex	
Male	10(100)
Female	0(0)
Age relating to May 2018	
≤ 65	2(20)
≥ 65	8(80)
Education	
Illiterate	0(0)
Up to 8 years	2(20)
More than 8 years	8(80)
Family History of Cancer	
Yes	5(50)
No	6(60)
Smoker at diagnosis	
Yes	8(80)
No	2(20)
Alcoholic at diagnosis	
Yes	8(80)
No	2(20)
T1	0(0)
T2	7(70)
T3	3(30)
T4	0(0)
Clinical Staging	
I	0(0)
II	7(70)
III	3(30)
IV	0(0)
Histological Type	
Squamous Cell Carcinoma	9(90)
Others	1(10)
Permanent Tracheotomy	1(10)

Table 2. Results of the Videofluoroscopy of Deglutition and ASHA NOMS Scale.

Patient (n=10)	ASHA NOMS	Aspiration	Stasis*					
			Arytenoid (s)/ Penetration	Posterior Pharyngeal Wall	Valeculia	on the base of Tongue	Superior Esophageal Sphincter	Pyriiform Recesses
1	7	1	1	1	1	1	1	1
2	7	1	1	0	1	1	1	1
3	4	1	1	0	1	1	1	1
4	7	0	1	0	1	1	0	1
5	5	0	1	1	1	1	1	1
6	7	0	0	0	1	1	0	1
7	6	0	1	0	1	1	0	1
8	6	0	1	0	1	1	0	0
9	7	0	0	0	0	1	0	1
10	5	0	1	1	0	1	0	0
n(%)	-	3(30)	8(80)	3(30)	8(80)	10(100)	4(40)	8(80)

Key:

0 = No;

1 = Yes;

ASHA NOMS = National Outcomes Measurement System of the American Speech-Language Hearing Association Scale;

*according to the location or anatomic region.

Discussion

Predominance of infiltrative or ulcerative T2 and T3 tumors described in this analysis indicate that this surgical procedure is more frequently prescribed for the treatment of intermediate and advanced stage tumors. Similar findings were observed in studies carried out in different countries of Europe and in the United States of America where HPLs (Horizontal Partial Laryngectomies) were indicated for tumors with staging and size similar to that of the present study¹¹⁻¹⁶.

Only one patient needed permanent tracheotomy, which showed the effectiveness of the anatomical structures reconstruction and the functional maintenance of horizontal open partial laryngectomies⁴, despite the surgical extension was broader than expected. Considering that 90% of the patients evaluated did not require maintenance of the tracheotomy and all of them maintained oral feeding and hydration, it is possible to suggest the success of the surgical reconstruction, since the procedure was developed with the intention of being a viable alternative to total laryngectomy for selected tumors^{11,16,17}.

The literature has been limited in approaching functional results of Extended STPL. Nevertheless, based on horizontal open partial laryngectomies, it can be inferred that the most frequent functional

complications would be those related to swallowing. Therefore, the presence of stasis and aspiration in the VDF (Videofluoroscopy of Deglutition) analysis of patients in the present study was already predicted superficially by some authors^{15,18,19,21}.

According to the ASHA NOMS scale, only one patient, who presented aspiration during the evaluation, required moderate dietary restrictions (level 4), that is, adaptations or limitations of consistency in oral feeding. The other aspirating patients (N=2) are at level 7, with stasis in the structures represented in Table 2.

The general contraindications for the STPL procedure are: uncontrolled diabetes mellitus; severe chronic obstructive pulmonary disease; psychiatric syndromes; personal motivations; neurological problems that impair the ability to spit and/or the ability to swallow; or severe heart disease. In this way, the group registered to perform the procedure has a lower risk of complications after treatment^{24,25}. The literature suggests that advanced age, an important cut-off point for indication of surgical treatment, is not considered to be an exclusion criterion for STPL. In the present study, all aspirating participants (N=3) were over 65 years old^{10,26}.

With regard to the postoperative time, the findings of this study showed that patients who had been through surgical resection within more than

9 months (≥ 9 months) ($N = 5$) did not have silent aspiration and had lower stasis in the evaluated regions. The aspirating patients ($N = 3$), however, had had the operation four, six and eight months before. Therefore, better functional results were observed in the patients with more than nine months of STPL and rehabilitation, which may suggest the effectiveness of the long-term speech-language pathology management and functional adaptation of the remaining structures for swallowing function.

Because of the focus on the laryngeal phase in order to understand the efficacy of the new swallowing process, the airway protection and the neolaryngeal competence, the individual's oral phase of swallowing was not evaluated in this study. Nevertheless, the high residue index, mainly on the base of tongue, can represent important changes in the ejection of the bolus as well as in the transit of it.

The Extended STPL in THEP reconstruction is a highly complex procedure used in cautiously selected patients and requires follow-up by a specialized multiprofessional team at all times of treatment. The success in managing these patients, who present nutrition and hydration exclusively by oral ways, is reached with specialized speech-language pathology therapy attendance at all times of the treatment, which occurred in the reference hospital in oncology. These patients do not show neurological disorders, they are treated in the outpatient clinic, are non-institutionalized, clinically stable and, therefore, they are not considered fragile individuals. It is important to highlight that, although these patients had aspiration and stasis, up to the moment of the study, such occurrence did not cause greater clinical impact and they were able to adapt to the neolarynx and to the new swallowing process.

Considering the extent and behavior of the tumors in the patients of this study, all of them would be eligible to undergo a total laryngectomy in any other institution. This procedure takes into account larger areas of resection and, therefore, higher functional impact on the life of individuals. By means of this study, it was noticed that the effect on swallowing, under the auspices of speech-language pathology therapy, remains after results associated with the treatment. Nevertheless, the presence of aspiration and stasis are managed with extreme care and caution, which supports the claims concerning speech-language pathology therapy work and reinforces its importance for the

improvement of quality of life, independence and swallowing function of the patients. The Extended STPL in THEP reconstruction, with functional neolaryngeal presence in the selected group, is a viable option to total laryngectomy.

The high incidence of cancer associated with smoking and alcoholism reinforces the need of public policies for preventing the advent of new smokers as well as reeducating and raising awareness regarding passive or active smoking. The prevalence of males asserts the need to consolidate the National Policy for Integral Attention to Man's Health, already in force, along with raising the awareness of this public towards its real importance²⁷⁻²⁸.

A new study with an expanded group as well as the analysis of interference of the detailed functional results after treatment in the quality of life of individuals are already underway and may be complementary to the scientific management of this new surgical approach and therapeutic intervention in Brazil.

Conclusion

The population submitted to Extended STPL in the THEP reconstruction, in this study, was composed of men, mostly elderly, alcoholics and smokers who presented intermediate and advanced staging. The functional results of swallowing showed 30% of silent aspiration and a large number of stasis in several anatomical regions (mainly the base of tongue). All of them showed nutrition and hydration capacity without alternative feeding pathways with efficient compensatory strategies when necessary. Patients with more than 9 months of surgery had better results in swallowing dynamics. Swallowing was sufficiently restored after surgery due to specialized speech language pathology therapy attendance at all times of the treatment in the oncology reference hospital.

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