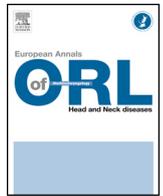




Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en



Original article

Assessment of swallowing function after circumferential pharyngolaryngectomy. A multicenter study by the GETTEC group

S. Morinière^{a,*}, P. Gorphe^b, F. Espitalier^c, D. Blanchard^d, N. Fakhry^e, N. Saroul^f, C. Bach^g, X. Dufour^h, C. Fuchsmannⁱ, S. Vergez^j, S. Albert^k

^a Service d'ORL et de CCF, CHU Bretonneau, 2 Bd Tonnellé, 37000 Tours, France

^b Service d'ORL et de CCF, IGR, 94800 Villejuif, France

^c Service d'ORL et de CCF, CHU de Nantes, Nantes, France

^d Service d'ORL et de CCF, CHU de Caen, Caen, France

^e Service d'ORL et de CCF, CHU de Marseille, Marseille, France

^f Service d'ORL et de CCF, CHU de Clermont-Ferrand, Clermont-Ferrand, France

^g Service d'ORL et de CCF, Hôpital Foch, Paris, France

^h Service d'ORL et de CCF, CHU Poitiers, Poitiers, France

ⁱ Service d'ORL et de CCF, CHU Lyon, Lyon, France

^j Service d'ORL et de CCF, CHU Toulouse, Toulouse, France

^k Service d'ORL et de CCF, CHU Bichat, 75877 Paris, France

ARTICLE INFO

Keywords:
Pharyngolaryngectomy
Free flap
Swallowing
Cancer

ABSTRACT

Objective: Circumferential pharyngolaryngectomy is performed for advanced pharyngeal tumor or in a context of postradiation recurrence. Several free or pedicle flaps have been described for pharyngeal defect reconstruction, with choice at the surgeon's discretion. The aim of this study was to evaluate long-term swallowing function according to the type of flap used for reconstruction.

Material and method: A multicenter retrospective study was conducted from January to September 2016 within the French GETTEC head and neck tumor study group. All patients in remission after circumferential pharyngolaryngectomy were included and filled out the Deglutition Handicap Index (DHI) questionnaire and underwent swallowing function fiberoptic endoscopy assessment. 46 patients (39 men, 7 women) were included. Reconstruction used a tubularized forearm free flap (FFF group) in 19 cases, pectoralis major myocutaneous flap (PMMF group) in 15 cases and free jejunum flap (FJF group) in 12 cases.

Results: Mean DHI was 24: 20 in the FFF group, 23 in the FJF group and 25 in the PMMF group, without significant differences. 27 patients had normal swallowing, 9 mixed diet, 8 liquid diet and 3 were fed by gastrostomy. On endoscopy, free flaps (FJF and FFF) were associated with significantly greater rates of normal swallowing of saliva and yogurt than in the PMMF group ($P=0.04$).

Conclusion: Type of flap reconstruction after circumferential pharyngolaryngectomy had no significant impact on postoperative swallowing function assessed on the self-administered DHI questionnaire.

© 2018 Elsevier Masson SAS. All rights reserved.

1. Introduction

Total circumferential pharyngolaryngectomy is implemented in first line in advanced pharyngeal tumor or for postradiation recurrence. Several pharyngoesophageal reconstruction techniques are used. Radial forearm free flap (FFF) [1], free jejunum flap (FJL) [2] and pectoralis major myocutaneous flap (PMMF) following Spriano et al. [3,4] are the 3 reference techniques used in the French

GETTEC head and neck tumor study group, with the choice usually at the surgeon's discretion. The oncological results are well known, with less than 30% overall 3-year survival [5]. Two studies [6,7] assessed functional impact on swallowing, based on food texture (normal, mixed, liquid or enteral), without questionnaire or objective assessment by videofluoroscopy or nasal fiberoptic endoscopic swallowing assessment. The present study aimed to assess swallowing on a self-administered questionnaire, the Deglutition Handicap Index (DHI) and nasal fiberoptic endoscopy with various food textures. The secondary objective was to screen for prognostic factors to guide choice of pharyngoesophageal reconstruction flap.

* Corresponding author.

E-mail address: moriniere@univ-tours.fr (S. Morinière).

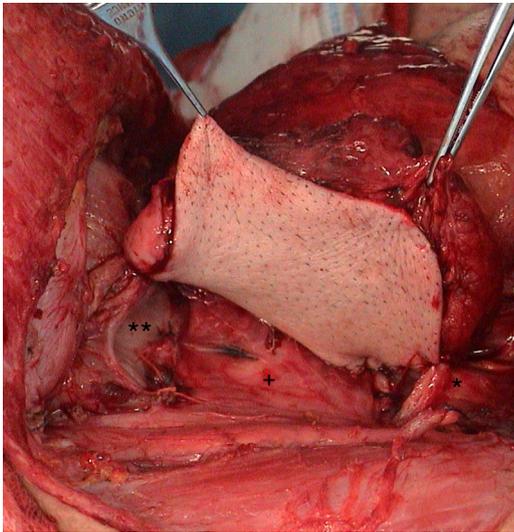


Fig. 1. U-shaped pectoralis major myocutaneous flap suture following Spriano et al. (3) for reconstruction of total circumferential pharyngolaryngectomy *: cervical esophagus; **: oropharynx; + prevertebral fascia.

2. Material and method

A multicenter retrospective study was conducted for the period January–September 2016 in 11 French reference centers involved in the GETTEC, including all patients in clinical and radiological remission after total circumferential pharyngolaryngectomy. Reconstruction used 1 of the 3 study techniques: FFF, PMMF or FJF. Reconstructions using other flaps (dorsalis major, anterolateral thigh) or pharyngolaryngectomy associated to total esophagectomy were excluded. Study parameters comprised: age, gender, primary site, flap type, postoperative complications such as pharyngostoma or stenosis, radiation and/or chemotherapy, and type of feeding (normal, mixed, liquid, enteral). Forty-six patients (39 male, 7 female) were included; 4 were excluded due to use of other types of flap. Staging on UICC TNM classification (7th edition) comprised 5 T2, 14 T3 and 27 T4, with isolated hypopharyngeal location in 32 cases and extension to the upper esophageal sphincter in 14. Flaps comprised: 19 FFF, 15 PMMF and 12 FJF.

FFF was a relatively thin microanastomosed cutaneous and subcutaneous free forearm flap tubularized so as to be able to reconstruct the pharynx. FJF was a free flap harvested from an intestinal loop, to reconstruct the neopharynx. PMMF (Fig. 1) was a thick pediculated myocutaneous flap using a wide skin paddle U-sutured onto the prevertebral fascia, following Spriano et al. [3].

Mean follow-up was 59 months (range, 26–84 months). Twelve patients showed pharyngostoma. Nineteen had undergone preoperative and 29 had postoperative radiation therapy, including 2 with repeat radiation.

Swallowing was assessed on the DHI questionnaire, comprising 30 items on 0–5 Likert scales (0=never; 5=always), in 3 10-item categories: S (swallowing), concerning swallowing kinetics; F (functional), concerning feeding and respiratory function; and E (emotional) concerning subjective experience. Scores < 11 were considered normal. Fiberoptic endoscopy was performed by the patient's surgeon in the respective center, to assess swallowing of saliva, water and yoghurt. Results were not checked by experts. Grading per texture was: normal, with stasis, or impossible.

Study variables comprised: flap type (FFF versus FJF versus PMMF, and free flaps versus PMMF), radiation therapy, tumor location (involving upper esophageal sphincter or not), and postoperative stenosis requiring dilations. Fisher exact test was used for qualitative variables (fiberoptic endoscopic assessment of swal-

lowing), and Kruskal-Wallis test for quantitative variables (DHI score). Significant values were then implemented in Fisher exact or Wilcoxon test on 2 × 2 tables as appropriate, with *P*-value correction following Holm. The significance threshold was set at *P* < 0.05 (indicated by asterisk in Table 1).

3. Results

Mean DHI was 24 (Table 2): DHI S=9; DHI F=9; DHI E=4. Twenty-seven patients reported normal swallowing, 9 required mixed diet, 6 liquid diet and 3 required gastrostomy. Mean DHI was 20 in FFF, 23 in FJF and 25 in PMMF, with no significant differences. There were no significant differences between the 3 DHI categories, or in DHI according to primary involvement of the upper esophageal sphincter or to radiation therapy before or after surgery. The other study criteria were likewise non-significant: pharyngostoma, gender, or follow-up time.

Fiberoptic endoscopic swallowing assessment, performed in 45 patients (Table 1), was normal for all textures in 58% of cases. There were no differences between textures according to type of flap. Free flaps (FFF or FJF) were associated with significantly higher rates of normal swallowing of saliva and yoghurt than PMMF (*P*=0.04 and *P*=0.005, respectively); there were no significant differences for water (Table 1). 40% of PMMF patients underwent dilation for stenosis, compared to 25% of FJF and 20% of FFF patients; this difference, however, was not significant (*P*>0.22).

4. Discussion

The present multicenter retrospective study of patients undergoing total circumferential pharyngolaryngectomy found a mean DHI of 24, without significant difference according to type of reconstruction, with normal swallowing for all textures in 58% of cases on fiberoptic endoscopy.

To our knowledge, the DHI has not previously been used for self-assessment of swallowing in this type of population; the present scores thus cannot be compared to results in other series. Self-administered questionnaires are subjective instruments, assessing

Table 1

Fiberoptic endoscopic assessment of swallowing following total circumferential pharyngolaryngectomy according to type of flap used for reconstruction: free forearm flap or free jejunal flap versus pectoralis major myocutaneous flap).

Type of feeding	Free flap n = 31	Pectoralis major flap n = 14	<i>P</i>
Saliva: normal	25 (80.7%)	5 (35.7%)	<i>P</i> = 0.005 ^a
Saliva: abnormal	6 (19.3%)	9 (64.3%)	
Yoghurt: normal	21 (67.7%)	5 (35.7%)	<i>P</i> = 0.04a
Yoghurt: abnormal	10 (32.3%)	9 (64.3%)	
Water: normal	28 (90.3%)	12 (85.7%)	<i>P</i> = 0.35
Water: abnormal	3 (9.7%)	(14,3%)	

^a Significant difference.

Table 2

Postoperative and functional swallowing results following total circumferential pharyngolaryngectomy with reconstruction using: free forearm flap (FFF), pectoralis major myocutaneous flap (PMMF), free jejunal flap (FJF).

Type of flap	Pharyngostoma	Normal feeding	DHI	Postop dilation	Gastrostomy
All (46)	27%	54%	24	28%	3
FFF (19)	44%	63%	20	21%	2
PMMF (15)	21%	53%	25	40%	1
FJF (12)	8%	58%	23	25%	0
	<i>P</i> = 0.1639	<i>P</i> = 0.1675	<i>P</i> = 0.36	<i>P</i> = 0.22	
	NS	NS	NS	NS	

DHI: Deglutition handicap index.

swallowing at the moment of testing [8,9]; reproducibility is thus variable, and scores can be discordant with clinical findings. Patients on mixed diet may have good DHI scores if they have adapted their way of life and psychologically accepted this functional sequela. Assessment needs to use several different criteria (objective and subjective) so as to mirror the patient's actual experience as faithfully as possible.

In the present study, cervical esophagus involvement did not impair swallowing, despite wider resection. This is because the cricopharyngeal muscles are resected in total circumferential pharyngolaryngectomy, leaving the superior sphincter of the esophagus non-functional. Other criteria related to tumor resection were not collated in the present study, due to the retrospective design, but have a strong impact on swallowing: e.g., extent of tongue-base muscle resection, or postoperative nerve XII and/or X palsy.

As can be seen in Table 1, no significant prognostic factors emerged for DHI according to type of flap; this was due to small sample sizes in the 3 subgroups. Objective fiberoptic endoscopy found significantly more frequent normal swallowing for water and yoghurt with free flaps (FFF or FJF) than with PMMF. Free flaps are thin and entirely tubular, whereas pectoralis major requires U-suture, which could account for these results with textures thicker than water. The present results are to be taken with caution, as they came from 10 different centers, with no centralized analysis of swallowing videos. In Chan et al.'s single-center study [6] of 202 patients undergoing total circumferential pharyngolaryngectomy with reconstruction using the same 3 types of flap, only 34% of PMMF patients had normal feeding, compared to 38% for FFF and 61.9% for FJF; their retrospective study indicated long-term superiority of FJF reconstruction for swallowing. However, swallowing assessment was not their main objective, and they distinguished simply between normal and non-normal feeding. In the study by Denewer et al. [7], 80% of patients with FJF reconstruction took solid food, compared to only 40% for PMMF; as in the present study, the subgroups were small and no recommendations can be made, because of bias due to multiple teams and retrospective design. Free flaps, and FJF in particular, are attractive for circumferential pharyngolaryngectomy reconstruction, as they provide digestive mucosa and intrinsic muscles that help the passage of the food bolus. Forearm flaps, however, are easier to harvest and offer a less heavy solution for fragile patients. The skin paddle may cause obstruction in swallowing; this is also the case for PMMF, where the thick muscle may increase the obstacle. PMMF, however, is an interesting alternative when a free flap is not feasible; 82% of patients receiving PMMF showed good swallowing in the study by Espitalier et al. [5].

We did not analyze reconstruction by free anterolateral thigh flap, as the sample size was too small. Yu et al. [10] reported useful

results for swallowing and esophageal phonation. Perez-Smith et al. [2] stressed the importance of experience in ensuring good functional results, with a learning curve on which the rate of post-operative fistula decreased considerably after 2 years' practice. Vocal rehabilitation is also an important factor in choice of flap, notably in terms of the possibility of fitting a phonation prosthesis; this was not dealt with in the present study.

5. Conclusion

The present study showed that the type of flap used for reconstruction after total circumferential pharyngolaryngectomy did not impact postoperative swallowing as assessed on the self-administered DHI questionnaire. In these fragile patients, it is important to propose the technique which the surgeon masters best, so that it will be reliable and reproducible with as few complications as possible and thus good functional outcome.

Disclosure of interest

The authors declare that they have no competing interest.

References

- [1] Fakhry N, Chamorey E, Michel J, et al. Salvage circular laryngopharyngectomy and radial forearm free flap for recurrent hypopharyngeal cancer. *Laryngoscope* 2013;123:910–5.
- [2] Perez-Smith D, Wagels M, Theile DR. Jejunal free flap reconstruction of the pharyngolaryngectomy defect: 368 consecutive cases. *J Plast Reconstr Aesthet Surg* 2013;66:9–15.
- [3] Spriano G, Piantanida R, Pellini R. Hypopharyngeal reconstruction using pectoralis major myocutaneous flap and pre-vertebral fascia. *Laryngoscope* 2001;111:544–7.
- [4] Spriano G, Pellini R, Roselli R. Pectoralis major myocutaneous flap for hypopharyngeal reconstruction. *Plast Reconstr Surg* 2002;110:1408–13.
- [5] Espitalier F, Ferron C, Leux C, et al. Results after U-shaped pectoralis major myocutaneous flap reconstruction of circumferential pharyngeal defects. *Laryngoscope* 2012;122:2677–82.
- [6] Chan YW, Ng RW, Liu LH, Chung HP, Wei WI. Reconstruction of circumferential pharyngeal defects after tumour resection: reference or preference. *J Plast Reconstr Aesthet Surg* 2011;64:1022–8.
- [7] Denewer A, Khater A, Hafez MT, Hussein O, Roshdy S, Shahatto F, et al. Pharyngoesophageal reconstruction after resection of hypopharyngeal carcinoma: a new algorithm after analysis of 142 cases. *World J Surg Oncol* 2014;12:182.
- [8] Woisard V, Andrieux MP, Puech M. [Validation of a self-assessment questionnaire for swallowing disorders (Deglutition Handicap Index)]. *Rev Laryngol Otol Rhinol (Bord)* 2006;127:315–25.
- [9] Crestani S, Moerman M, Woisard V. The "Deglutition Handicap Index" a self-administrated dysphagia-specific quality of life questionnaire: sensibility to change. *Rev Laryngol Otol Rhinol (Bord)* 2011;132:3–7.
- [10] Yu P, Lewin JS, Reece GP, Robb GL. Comparison of clinical and functional outcomes and hospital costs following pharyngoesophageal reconstruction with the anterolateral thigh free flap versus the jejunal flap. *Plast Reconstr Surg* 2006;117:968–74.