

Videofluoroscopy and videoendoscopy in evaluation of swallowing function in 31 patients submitted to surgery for advanced buccopharyngeal carcinoma

Studio videofluoroscopico e videoendoscopico della deglutizione in 31 pazienti trattati chirurgicamente per carcinoma buccofaringeo localmente avanzato

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Key words

Oropharyngeal cancer • Surgical treatment • Dysphagia • Videofluoroscopy • Microvascular reconstruction

Parole chiave

Carcinoma orofaringeo • Trattamento chirurgico • Disfagia • Videofluoroscopia • Ricostruzione microvascolare

Summary

Swallowing function has been evaluated by means of videofluoroscopy and videoendoscopy in 31 patients submitted to surgery for local extended bucco-pharyngeal carcinoma. Aim was to better predict functional deficits and subsequent recovery perspectives of patients as far as concerns swallowing. In 30 patients, surgery was combined with radiotherapy, pre-operative in 6 cases and post-operative in 24. Site and extension of resection were defined using Urken's classification of hard and soft tissue deficits. In 3 cases, resection included half of tongue base and was followed by direct closure of the surgical defect. In 4 cases, the entire hemitongue (hemibody and hemibase) was resected and repair was performed with a free flap. In 5 cases, the whole tongue base was resected (posterior glossectomy). In 2 of these, direct closure of the gap was performed while the other 3 received a free flap. Another 3 cases required resection of the entire mobile tongue with corresponding buccal floor. All were repaired with free flaps. In 6 cases, resection comprised half the tongue base and adjacent tonsillar fossa and was performed using a transmandibular approach (demolitive in 3 cases, reconstructive in 3). Of these patients, 3 received direct closure and 3 reconstruction with a free flap. In 4 patients, resection included the tonsillar fossa and soft palate while in 5 other patients the whole soft palate was resected in addition to the tonsillar fossa. All these 9 patients received repair with free flaps. The remaining patient underwent resection of the entire oro-hypopharyngeal posterior wall, reconstructed with a free flap. During video-endoscopy examination, both liquid and soft meal ("pudding") were given to patients. Diagnostic parameters studied were: grade of pharyngo-laryngeal sensitivity, latency in onset of pharyngeal swallowing reflux, drop of the bolus in pre-swallowing phase, grade of the pharyngeal residual, inhalation and pooling of saliva. Data collected may be usefully employed not only in predicting the type and grade of swallowing deficit related to the extension of resection and

Riassunto

Gli Autori hanno eseguito uno studio videofluoroscopico e videoendoscopico della deglutizione in 31 pazienti trattati chirurgicamente per carcinoma buccofaringeo localmente avanzato. L'obiettivo è stato quello di fornire un contributo ad una migliore caratterizzazione del difetto della funzione deglutitoria e, se possibile, a valutare le prospettive del possibile compenso funzionale. In 30 pazienti il trattamento chirurgico è stato associato ad un trattamento radioterapico (RT), preoperatorio in 6 casi, postoperatorio in 24 casi. L'estensione della demolizione è stata identificata attraverso la classificazione dei difetti post-chirurgici, sia del tessuto osseo che dei tessuti molli, proposta da Urken. In 3 casi la resezione comprendeva l'emibase linguale e la chiusura del difetto anatomico è stata effettuata mediante sutura diretta. In 4 casi è stata resecata l'intera emilingua (emibase ed emicorpo linguale) e la ricostruzione è avvenuta tramite lembo libero microvascolare. In 5 casi è invece stata resecata l'intera base linguale (glossectomia posteriore). In 2 casi il difetto è stato riparato mediante sutura per prima intenzione mentre negli altri 3 casi si è utilizzato un lembo libero. Tre altri casi avevano ricevuto la resezione dell'intero corpo linguale con il rispettivo pavimento orale, ed in tutti i tre casi la ricostruzione è stata effettuata mediante lembo libero. In 6 casi la resezione interessava l'emibase linguale e la loggia tonsillare ipsilaterale ed è stata effettuata mediante approccio transmandibolare (demolitivo in 2 casi e ricostitutivo in 4). In 3 casi il difetto è stato riparato per prima intenzione mentre negli altri 3 casi è stato utilizzato un lembo libero. In 4 pazienti la resezione ha interessato la fossa tonsillare ed il corrispondente empalato molle mentre in altri 5 pazienti oltre la fossa tonsillare la resezione interessava l'intero palato molle; tutti e 9 i pazienti hanno ricevuto la ricostruzione del loro difetto chirurgico mediante lembo microvascolare (4 lembi radiali, 3 lembi laterali di coscia, 2 laterali del braccio). L'ultimo paziente ha invece ricevuto la resezione dell'intera parete posteriore faringea che è stata ricostruita mediante lembo libero. L'esame videofluoroscopico è stato effettuato utilizzando una sospensione di mezzo di contrasto (250% P/V) con idonee caratteristiche di diluizio-

repair technique used, but could also be helpful in the choice of the most appropriate behavioural procedure of rehabilitation for the patient.

Introduction

Surgical treatment of locally extended bucco-pharyngeal carcinoma is still, to-day, one of the more difficult problems for the head-and-neck surgeon to solve. Severe prognosis suggests, for reasons of macro- or microscopic radicality, maximally extensive resectioning, that is counterbalanced by the necessity of sparing all of those structures able to facilitate both the healing and reestablishment of the two principal features ascribable to this area. These are deglutition and phonoarticulatory function, respectively, upon which will chiefly depend the quality of life remaining to the patient. The modalities currently in use to define functional results, following such surgery, are derived either from score-based evaluation systems obtained from the patient's subjective responses or from different types of examinations which provide elements of objective evaluation. Examples of such examinations are: videofluoroscopy, videoendoscopy, echography, scintigraphy, manometry, manofluorography¹⁻⁷. However, of these, only the first two, although presenting recognized limits⁸⁻¹², have been widely used, above all on account of the ready availability, the fact that they are relatively easy to use and offer reliable data, whereas the others, although, offering highly significant objective data (scintigraphy) or elucidating important accessory aspects (echography, manofluorography), have not entered into routine use.

In the present investigation, use has been made of videofluoroscopy and videonasaloryngoscopy to study deglutition in 31 patients undergoing resections, of varying amplitude of the bucco-pharyngeal tissues, for locally advanced neoplasia. The aim was to contribute towards a better pre-operative identification of the prospectives for functional recovery related to a set type of demolition and to the corresponding plastic reconstruction.



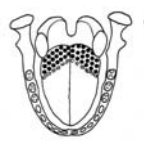
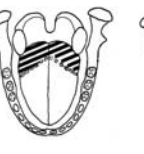

Patients and methods



Between 1997 and 2003, 31 patients undergoing demolitive surgery for locally advanced bucco-pharyn-

ne. Durante la videoendoscopia i pazienti erano invitati a deglutire sia un bolo semisolido (budino) che liquido. I parametri considerati nella videoendoscopia sono stati: il grado di sensibilità laringo-faringea, la latenza dell'inizio del riflesso deglutitorio faringeo, la eventuale caduta predeglutitoria del bolo, il grado del residuo faringeo, l'inalazione e il grado di ristagno salivare. I dati concorrono a prevedere il tipo ed il grado di deficit deglutitorio in base all'estensione della resezione e alla tecnica chirurgica di riparazione utilizzata ed appaiono utili nell'indicare la scelta della tecnica di riabilitazione più appropriata per ogni singolo paziente.

geal neoplasia were submitted to videofluoroscopic and videoendoscopic examinations. In 6 patients, surgery was carried out following lack of response to radiotherapy (RT) performed with a curative intent; 24 patients underwent complementary post-operative RT, whilst one patient was submitted only to surgery. The extent of the demolition and subsequent reconstruction was identified using the classification of post-surgical defects, either of hard or soft tissues, proposed by Urken in 1991¹³. In 3 cases, resection comprised the tongue hemibase, with direct closure of the surgical defect. In 4 cases, the entire hemitongue (hemibase and hemibody) was resected and then reconstructed with a microvascular free flap (3 lateral thigh flaps and one lateral arm flap). In 5 cases, however, the entire tongue base was resected (posterior glossectomy). In 2 cases, direct closure was performed, whilst in the other 3 cases, a free flap was used (lateral arm flap). Three other cases had undergone resectioning of the entire tongue body and the respective buccal floor, and reconstruction was performed using a free flap (2 lateral thigh flaps and one abdominal fasciocutaneous flap). In 6 cases, resectioning involved the tongue hemibase and the adjacent tonsillar fossa and was performed using a transmandibular approach (demolitive in 2 cases, reconstructive in 4). In 3 cases, direct closure was performed, whilst in the other 3, a free flap was used (rectus abdominis flap). In 4 patients, resectioning included the tonsillar fossa and the corresponding soft hemipalate, whilst in 5 other patients, not only was the tonsillar fossa resected, but the entire soft palate; in all these 9 patients, reconstruction of the operation area was performed using microvascular flaps (4 radial flaps, 3 lateral thigh flaps, 2 lateral arm flaps). The remaining patient, however, underwent resection of the entire posterior pharyngeal wall, which was reconstructed with an antibrachial microvascular flap. Videofluorographic examination was performed using high-density (250% W/V) barium meal diluted with 100 ml of water, with the administration of at least 2 boluses of 5-7 ml. In cases of suspected inhalation, examination began with boluses of 2-3 ml. A semisolid paste (biscuits mixed with barium meal) was administered¹² to those patients not showing

Table Ia. Videofluoroscopy (VF): results.

Number of cases VF					
Type of reconstruction	DIR. 3	RF 3	DIR. 2	RF 3	RF 4
Oral pooling	No	Yes (mild)	No	No	Yes
Pharyngeal pooling	3 out of 3 (mild)	Yes (mild)	Yes	Yes	Yes
Inhalation	No	No	Yes (moderate)	Yes (mild)	Yes (mild)
Reduction of pharyngeal contraction	No	No	Yes (1 out of 2)	No	Yes (1 out of 2)
Rhino-pharyngeal reflux	No	No	No	No	No

DIR. = direct closure  RF = revascularized flap 



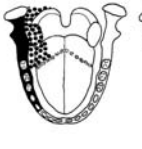
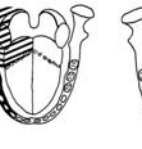

signs of inhalation. The following parameters were taken into consideration for each examination: barium residue at oro-pharyngeal level, inhalation, reduction of pharyngeal contraction, rhino-pharyngeal reflux. During videoendoscopy, patients were given both semisolid (“pudding”) and liquid material to swallow. Parameters taken into consideration for videoendoscopy were: degree of laryngo-pharyngeal sensitivity (produced by contact of the instrument with the mucosa), pharyngeal swallowing reflex onset latency, eventual pre-swallowing bolus drop, degree of pharyngeal residue, inhalation, degree of saliva pooling. In order to avoid the possible influence of temporary RT effects, on the recovery of deglutition functions, the functional evaluation was carried out at least 3 months after the end of RT. Results of the study are presented in Tables I a, b and II a, b.




Discussion

The study of deglutition function deficits produced by extensive surgery for neoplasia of the oral cavity

and pharynx is both important and complex, especially on account of the paucity of information available in the literature. It is important above all because of the surgeon needs to correctly forewarn the patient of the real extent of functional damage on which will for the most part depend his or her remaining life quality. It is however complex to consider the elevated number of variables influencing to a greater or lesser degree the quality of deglutition functions in these patients (Tab. III). As far as concerns the site and extent of the resection, it would appear evident, as already underlined by others¹³⁻¹⁵, that to define, with any degree of accuracy, the amount of post-operative function compromised, it is mandatory to precisely identify both the anatomic site of the neoplasia and the exact extent of the demolition, both quantitatively and qualitatively (muscle, bone, nerve). To this end, Urken’s classification¹³, although apparently complex, would certainly appear the most complete compared to the other classification schemes^{9,16}. This classification which, moreover, takes into account eventual innervation damage also allows maintenance of motor and sensory functions of the oro-pharyngeal region to be taken into consideration. This

Table 1b. Videofluoroscopy (VF): results.



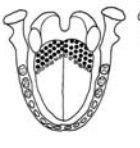




Number of cases VF					
Type of reconstruction	DIR 4	RF 5	DIR 3	RF 3	RF 1
Oral pooling	No	Yes (mild)	Yes 1 out of 3	Yes 2 out of 3 (severe)	No
Pharyngeal pooling	Yes (mild)	Yes (mild)	Yes 3 out of 3 (mild)	Yes (moderate)	Yes
Inhalation	No	Yes (mild)	Yes (moderate, mild)	Yes 2 out of 3 (mild)	Yes (S)
Reduction of pharyngeal contraction	No	Yes 1 out of 2	Yes 3 out of 3	Yes	Yes
Rhino-pharyngeal reflux	Yes (mild)	Yes (1 out of 2)	No	No	No

DIR = direct closure  RF = revascularized flap  Partial mandibulectomy 

aspect appears particularly important, both in terms of evaluating motor activity of the residual structures (tongue, palate, cheek, pharynx) and because tongue, pharynx and larynx sensitivity constitute essential requisites for correct deglutition. The type of reconstruction undoubtedly constitutes another of the fundamental aspects influencing functional recovery. Wherever possible, direct suturing of the edges of the resection represent, without doubt, the most favourable solution, as a result also of greater preservation of surface sensitivity. It must, however, be stressed that such reconstruction should not severely limit residual tongue movement or movement of any other structures as this would lead to a clear deterioration in bolus modelling in the functional deglutition canal. In cases in which reconstruction requires the use of a pedunculated flap (PF) or revascularized flap (RF), it should be pointed out that the few comparative data available in the literature ¹⁷, show no functional differences of note between the 2 methods, even if PFs, due both to the tissue component

and the shape of the cutaneous island (not easy to model), is far less adaptable to the surgical field compared to microvascular flaps. With the latter, in fact, the tissue component can be adequately prearranged choosing from a series of options (fasciocutaneous, myocutaneous, osteomyocutaneous flaps). In some cases (forearm flap, lateral arm flap, lateral thigh flap, rectus abdominis flap), the cutaneous island can be shaped in various ways (plurilobulated edges) and folded over with the aim of better responding to the characteristics of anatomic three-dimensionality of the demolished region ^{3 18} (Figs. 1, 2). Even if reports of experience appearing in the literature are still far from being representative, some of these RFs offer the theoretical prospective of restoring partial sensitivity to the resected zone thanks to the possibility of nervous anastomosis ¹⁹⁻²². Modifications in the hyolaryngeal complex also contribute to determining post-swallow aspiration ²³. These may be due to interruption of the muscles of the lingual pelvis, to neck scarring phenomena and to the presence of tracheostomy.

Table IIa. Videonasolaryngoscopy (VE): results.

Number of cases VE					
	DIR 3	RF 3	DIR 2	RF 3	RF 4
Type of reconstruction	DIR 3	RF 3	DIR 2	RF 3	RF 4
Reduction of sensitivity	Mild	Moderate	Mild		Moderate
Alteration of latency	Increased	Reduced	Unchanged		Increased
Pre-swallowing bolus drop	No	Yes	Yes 1 out of 2	Yes	Yes
Pharyngeal residue	Yes	No	Yes	Yes	Yes (mild)
Pooling of saliva	No	No	No	Yes	Yes
Inhalation	No	No	Yes (moderate)	Yes (mild)	Yes (moderate)
DIR = direct closure  RF = revascularized flap 					



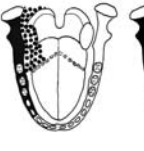


Previous or post-operative complementary RT is another factor unfavourable to deglutition due to the onset of well-known side-effects, both temporary (mucosity, oedema, pain) and permanent, such as xerostomia, oedema and tissue fibrosis^{20 23-25}. The latter, in particular, is considered to be responsible for the reduction of the at rest aero-pharyngeal lumen and the consequent decrease in the pressure and volume gradient during contraction²⁶. The videofluoroscopic and videoendoscopic examination, already in use, for some time, in our institute to evaluate dysphagia following neck surgery and oro-pharyngeal dysphagia generally allows us to detect some situations which, although requiring statistically more significant confirmation, would appear, in our opinion, to offer useful indicators of the possible functional recovery following a pre-determined type of operation.

- Extensive resections including the anterior 2/3 of the tongue and corresponding buccal pelvis, reconstructed with a remodelled free fascio-cutaneous flap, allow good results as far as concerns both swallowing and the phono-articulatory profiles, provided conservation of the hypoglossal

nerves is possible. This would appear to indicate that the musculature of the tongue base remnant is sufficient to determine, with the help of a facilitatory position, good bolus propulsion towards the oro-pharynx.

- Resections of the tongue hemibase repaired with a direct suture do not appear to lead to any particular functional alterations, which, however, become more evident with the progressive extension to the entire tongue base. However, in such situations, we have not observed any significant differences, given an identical preservation of sensory and motor innervation, between those cases in which a free revascularized flap was used and those closed with a direct suture. The use of the free flap probably maintains better word articulation, due to the lesser traction, compared to the direct suture, on the residual body and tip of the tongue.
- In resections involving the amygdalo-glossopalatine region, no substantial differences were observed with respect to the use, or otherwise, of the microvascular flap or to the demolition of the ascendant ramus of the mandible. The functional

Table IIb. Videonasolaryngoscopy (VE): results.

Number of cases VE					
Type of reconstruction	RF 4	RF 5	DIR 3	RF 3	RF 1
Reduction of sensitivity	No	Moderate	Yes	Yes	Absent
Alteration of latency	Increased	Increased	Increased		Increased
Pre-swallowing bolus drop	No	Yes 1 out of 2 (mild)	No	Yes 2 out of 3	Yes (severe)
Pharyngeal residue	Yes (mild)	Yes (mild)	Yes	Yes	Yes (severe)
Pooling of saliva	No	Yes 1 out of 2	Yes	Yes 2 out of 3	Yes
Rhinopharyngeal reflux	No	Yes (mild)	No	No	No
Inhalation	No	Yes (mild)	Yes 1 out of 3 (mild)	Yes 2 out of 3 (mild)	Yes (severe)




DIR = direct closure 
 RF = revascularized flap 
 Partial mandibulectomy 

Table III. Principal associated variants determining deglutition quality in patients undergoing surgery of oral cavity and oro-pharynx.

1. Site and extent of resection
2. Maintenance of motor function and oral region sensitivity
3. Type of reconstruction
4. Alteration of hyoid/larynx elevation
5. Previous and complementary radiotherapy
6. Elements of general character

defect, however present, increases markedly when the resection is pushed forward to involve the tongue hemibody or when, resection of the lateral pharyngeal wall is particularly extensive towards the midline.

- In the 4 cases in which the resection involved the soft palate, the successive exact anatomical reconstruction with revascularized flap allowed minimal aspects of nasal reflux to be obtained without significant alterations in the correct oro-hypo-pharyngeal transit, even in the event of its total resectioning.
- Resection of the entire posterior wall of the oropharynx, followed by reconstruction with a revascularized fascio-cutaneous flap, although considered in only one case, led to a marked bolus aspiration due to the absence both of reflexes and pharyngeal propulsion.
- In those cases in which it was possible to compare VFS and VNLS examinations, carried out before and after complementary RT, it was seen that it could cause deterioration, both temporary and permanent, to the quality of functional recovery.

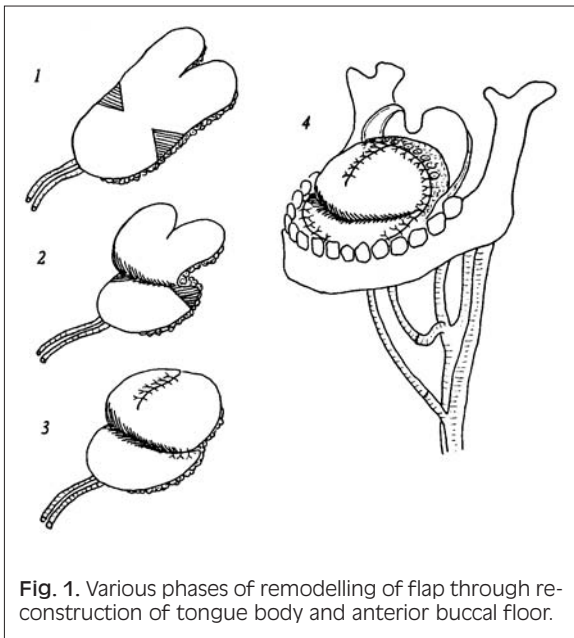


Fig. 1. Various phases of remodelling of flap through reconstruction of tongue body and anterior buccal floor.

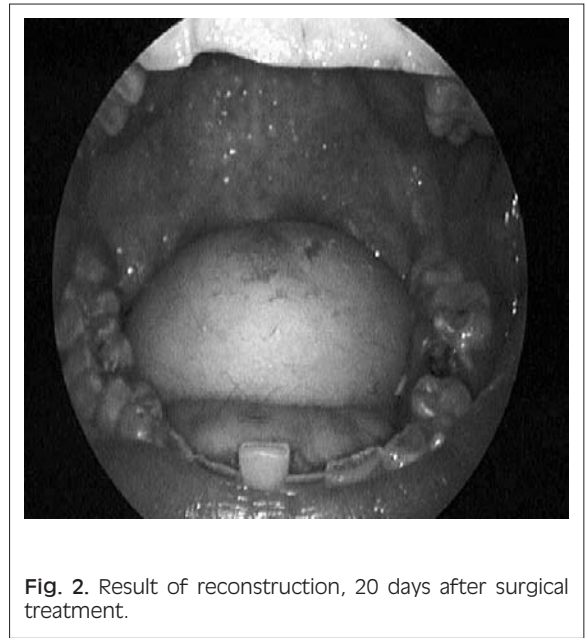


Fig. 2. Result of reconstruction, 20 days after surgical treatment.

Conclusions

The results obtained provide material for continuing with further research to establish more appropriate and objective methods for the study of oro-pharyngeal dysphagia following oncological surgery in this area. Certainly, one of the first problems to be solved is that concerning the best definition of the anatomic tissue defect (skin, bone, muscle, nerves) resulting from the demolition; in this respect, efforts must be

made to secure the use of commonly accepted homogeneous schemes. Correct evaluation of the variables related to functional impairment will lead to improvements in the interpretation and, in turn, the prospects for functional recovery offered to the patient. It should also be stressed that carefully informing the patient of his/her real prospects of recovery, together with a physiotherapist, expert in problems concerning swallowing, is one of the fundamental elements in achieving this goal.

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■ Received: November 18, 2003
Accepted: May 20, 2004

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