TITLE: Functional fat injection under local anesthesia to treat severe post-surgical dysphagia, a case report

Running title: Fat injection in the treatment of dysphagia

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Abstract

Background: in the present study we present the first application of functional fat injection (FFI) performed under local anesthesia in the treatment of severe dysphagia secondary to head and neck cancer (HNC) surgery.

Methods: FFI was performed using a transcervical approach. Control of injection depth and site was performed through a trans-nasal flexible endoscope. The effect of surgery was evaluated through videofluoroscopy (VFS), Fiberendoscopic Evaluation of Swallowing (FEES), Functional Oral Intake Scale (FOIS) and Eating Assessment Tool-10 (EAT-10).

Results: before the FFI the patient was dependent on permanent tube feeding, the VFS and FEES revealed a severe impairment of swallowing abilities. The EAT-10 scored 26. Twelve months after surgery the patient was on oral diet, the VFS demonstrated mild to moderate dysphagia, the FEES demonstrated aspiration only with liquids and the EAT-10 improved.

Conclusions: FFI under local anesthesia could be useful in the treatment of chronic dysphagia in selected patients.
**Introduction**

Dysphagia occurs frequently in patients with head and neck cancer (HNC); in particular dysphagia and aspiration pneumonia are common complications after partial laryngectomies (PL) and severely impact on quality of life (QOL) [1]. Although, behavioural swallowing rehabilitation allows adequate management in most of the cases, tube feeding is required in a minority of patients. In order to overcome this problem, some authors recently proposed a new treatment for dysphagia following surgery and/or chemoradiotherapy through polydimethylsloxane or fat injections [2, 3]. In particular, Kraaijenga et al [3] reported their promising experience with lipofilling of the tongue base in the treatment of six HNC patients with chronic dysphagia secondary to surgery and/or chemoradiotherapy. Also Navach et al [4], reported satisfactory swallowing results after lipofilling of the tongue base in a patient treated with radiation therapy for a nasopharyngeal carcinoma and consequent severe post-radiation dysphagia. In this case report we present the first application of fat injection performed under local anesthesia in the treatment of severe therapy-refractory dysphagia secondary to supraglottic laryngectomy. The underlying hypothesis is that in some patients the tissue loss related to HNC surgery might reduce airway protection acting as a funnel toward the larynx, thus the correction of tissue loss using fat injection might improve the safety of swallowing. In addition, local anesthesia could provide a “functional” display of the operative field, since the patient is awake and able to swallow, thus allowing to monitor the effect of surgery on swallowing in real-time.
Case report

A 76 years old patient presented at our institution for severe chronic dysphagia. In January 2012 he underwent a horizontal supraglottic laryngectomy partially extended to the left arytenoid (OPHL Type I+ARY [5]) at another institution for a T3N0M0 supraglottic laryngeal squamous cell carcinoma. After the surgery he underwent adjuvant radiotherapy and subsequent oncologic follow-up was clinically and radiologically negative. However, from the time of the surgery he complained severe dysphagia and was unable to regain an oral diet. When he presented at our institution in November 2015 he was feeding tube dependent (Functional Oral Intake Scale [6], FOIS = 1).

Fiberendoscopic Evaluation of Swallowing (FEES) was performed according to Langmore protocol [7]. FEES demonstrated a mobile right arytenoid and an important tissue loss in the tongue base, especially on the left side (see Figure 1a). Solid, semisolid and liquid textures with volumes of 5 ml and 10 ml were tested and constant intra-swallowing aspiration and moderate pooling of food at the tongue base with post-swallowing penetration and aspiration was detected with all consistencies (Penetration Aspiration Score [8], PAS = 7) (see Figure 1b). The patient underwent behavioral swallowing therapy twice a week for 6 months. Behavioral swallowing therapy included postural techniques, swallowing maneuver (super-supraglottic swallow), daily muscle strengthening (Masako and Shaker exercise, tongue reinforcement with IOPI device) and percutaneous neuromuscular electrical stimulation. Swallowing function modification was checked monthly through FEES, showing no substantial improvement, although patient motivation and adherence to therapy were high. Videofluoroscopic (VFS) examination was performed with 5, 10 and 20 mL with liquid and semisolid textures; solid texture was tested as well. Each volume and consistency was tested 3 times and revealed severe dysphagia with aspiration due to ineffective airway protection secondary to surgery (Dysphagia Outcome and Severity Scale [9], DOSS = 1) (see Figure 2). Aspiration with different consistencies occurred often but in small volume thanks to cough (Safety, S, = 3 in Dynamic Imaging Grade of Swallowing Toxicity, DIGEST, scale [10]), while residue was less than half with all consistencies (Efficiency, E, = 1 in DIGEST scale), with a
DIGEST scale score of 3. With all consistencies bolus oral transport, initiation of pharyngeal swallow and soft palate elevation were considered normal, laryngeal elevation and anterior hyoid bone movements were slightly reduced; laryngeal closure was reduced and tongue base retraction was slightly reduced. Pharyngeal contraction and stripping wave appeared normal, while indentation of the UES was visible.

Careful analysis of the FEES recording, clearly showed that intra-swallowing aspiration was related to tongue base tissue loss acting as a funnel on the left side; besides, removal of left arytenoid was associated with loss of a clear separation between neolarynx and lateral channels. The patient was offered a functional fat injection (FFI) under local anesthesia in order to improve his swallowing function. The aim of FFI was to correct the tissue loss by filling the tongue base in order to facilitate the lateral slipping of the food preventing intra-swallowing aspiration and oro-pharyngeal pooling. The procedure was performed in an operating room under local anesthesia on a day hospital basis. This study was carried out according to the Declaration of Helsinki and was previously approved by Istitutional Review Board of our hospital. The patient gave his written informed consent. The surgeons clearly explained the whole procedure to the patient, whose active collaboration was necessary.

Surgical procedure

The patient was initially placed in a supine position. An infiltration of local anesthetic and vasoconstrictor solution was administered into the low peri-umbilical region, using two 20 cc syringes connected to a 22 Gauge needle, 9 cm. long. The liposuction was performed in the subcutis of the low peri-umbilical region, using a 10 cc disposable autostatic syringe, connected via luer-lock to Coleman cannula [11]. Lipoaspirate concentration was achieved through centrifugation for 3 minutes at 3000 rpm per minute as described by Coleman [11]. The concentrated fat was placed in 1 mL syringes connected to 20 gauge with blunt tip cannula. Once this task was completed, the patient was put in a semi-seated position. A 25-gauge needle with 1% lidocaine
hydrochloride was used to anesthetize the skin and subcutaneous tissues overlying the thyrohyoid notch. The flexible endoscope was inserted trans-nasally while FFI was performed using a transcervical–thyrohyoid approach [12] with a centralized injection. Small aliquots of fat were transferred with multiple passes at different depths in order to obtain augmentation of the tongue base [3]. A total volume of 5 cc was injected. This volume was not decided a priori but was related to the desired functional results (i.e. the reduction of tissue loss in the tongue base and improvement of dysphagia) and only a minor over injection was performed. Control of injection depth and site was performed through the flexible endoscope since the injection cannula was maintained under the mucosa and maneuvered in order to reach the chosen areas to be augmented (see the asterisks in Figure 1). A single injection was performed. In order to evaluate the effect of FFI on swallowing function, a FEES was performed intra-operatively using liquid and semisolid textures with volumes of 5 and 10 ml. Trace aspiration was detected only for liquids textures (PAS = 6 for liquids and PAS = 4 for semisolids) and residue was minimal.

Patient evaluation

Information regarding weight, number and type of complications occurred during and after the surgery were analyzed. In addition, the patient was evaluated before, after 1 week (first post-operative period), after 1, 6, and 12 months (second, third and fourth post-operative periods) from the surgical procedure through VFS (after 1 and 6 months) and FEES (after 1 week, 1, 6 and 12 months). During each of the post-operative medical examination patients’ oral intake was assessed using FOIS [6], while information regarding the perceived swallowing disorder were collected using the Italian version of the Eating Assessment Tool-10 (I-EAT-10) [13]. The scores of the latter range from 0-40, with higher scores indicating more swallowing problems.

Results
The patient well tolerated the liposuction and the surgical procedure and he did not complain any discomfort or pain during the procedure. No complications during or after the surgical procedure were reported. In particular, no edema in the neck, hemorrhage at the injection site or in the nose were noted post-operatively.

Before the surgery the patient was dependent on permanent tube feeding (FOIS = 1), the VFS demonstrated severe dysphagia (DOSS = 1) and also the FEES examination revealed a severe impairment of swallowing abilities (PAS = 7 with different consistencies) and moderate pooling in the oropharynx. The I-EAT-10 score before surgery was 26, suggesting perception of a severe swallowing impairment.

After 1 week, the FEES examination revealed a positive evolution of dysphagia since aspiration was demonstrated only for liquids (PAS = 6) but not for semisolids or solids, (PAS = 4 for semisolids and PAS = 3 for solids); only coating in the oropharynx was visible with liquids. The patient was than referred to the SLP of our institution and a modified oral feeding was prescribed. After 1 month, the patient reported a good evolution of his swallowing function and he was able to again resume consistent oral intake alongside his tube feeding (FOIS = 6). The VFS demonstrated mild to moderate dysphagia with trace aspiration of thin liquids only but with strong reflexive cough to clear completely (DOSS = 4) (see Figure 3). Trace aspiration was limited to liquids (S1 in DIGEST), while residue was minimal with all consistencies (E0 in DIGEST), with a DIGEST score of 1 (Table 1). With all consistencies bolus oral transport, initiation of pharyngeal swallow and soft palate elevation remained normal, laryngeal elevation and anterior hyoid bone movements were slightly reduced; laryngeal closure was almost normal and tongue base retraction was slightly reduced. Pharyngeal contraction stripping appeared normal, while indentation of the UES was still visible. Also the FEES examination demonstrated aspiration only with liquids (PAS = 6) but not with semisolids and solids, (PAS = 3 for semisolids and PAS = 2 for solids) and oropharyngeal coating with different consistencies. The improvement of PAS score for liquid texture is probably related to the improvement of airway protection which reduced the amount of aspirated liquid (only
trace aspiration was found during FEES). Probably for this reason the reflexive cough was strong enough to clear completely. The I-EAT-10 improved up to 9. These results were stable also after 6 months and consequently the feeding tube was removed. During the 6 months post-surgery enteral feeding was progressively reduced and oral feeding increased. With all consistencies bolus oral transport, initiation of pharyngeal swallow and soft palate elevation were considered normal, laryngeal elevation and anterior hyoid bone movements were slightly reduced; laryngeal closure was reduced and tongue base retraction was slightly reduced. Pharyngeal contraction stripping appeared normal, while indentation of the UES was visible; tube removal was agreed after two months of full oral feeding without complication. After 6 months, the effects of FFI were still maintained (Figure 4) and although no volumetric measure was possible during FEES, no significant reduction of inject fat was noted during endoscopic examination. The patient was on oral diet (FOIS = 6), the I-EAT-10 score was further improved to 4, a 6-kg increase in body weight was recorded and no bronchitis or aspiration pneumonia were reported from the time of the surgery.

Discussion

In the present study our experience in the treatment of chronic dysphagia secondary to surgery and refractory to behavioral rehabilitation was reported. To the best of our knowledge this is the first report on swallowing modification after FFI performed under local anesthesia. The results here reported appear promising and support the applicability of FFI in the treatment of chronic dysphagia secondary to HNC surgery.

Specific findings are noteworthy. In particular, the patient well tolerated both the liposuction and the FFI phase and no complications during or after the surgical procedure were reported. This datum could be related to the use of autologous fat. The latter causes less inflammation in the injection site because is less likely to cause an allergic reaction or local granulomatosis [14]. In addition, it might also assure the tissue regeneration which is related to the presence of stem cell included in the centrifuged autologous fat [15].
As far as the efficacy of the FFI is concerned, the results here reported suggest that this surgical technique provides good results both in the short- and in the long-term period. However, it must be noted that as the patients underwent prolonged swallowing therapy before and after the injection, the positive outcome should be considered as a result of both treatments provided. Both the VFS and FEES examinations demonstrated a positive evolution of dysphagia. The oral intake dramatically improved and the patient was able to remove the tube feeding and regain an oral diet with restrictions. Finally, also the results obtained in the I-EAT suggested a positive evolution of swallowing disorder perception after the surgery. It is consequently possible to speculate that FFI might improve swallowing because the tongue base injection corrected the tissue loss and this facilitated the lateral slipping of the food, thus improving the airways protection and reducing the oropharyngeal pooling. In addition, the injected fat could also play a role in facilitating bolus propulsion. In the future, manometry would be a useful tool in investigating this hypothesis. Moreover, also MRI performed before and after fat injection would be useful in order to evaluate the amount of fat loss during the follow-up period. Consequently, caution should be applied in reading the results here reported, as they derive from a single case and no evaluation of fat survival and/or tissue augmentation was performed.

To date, fat injection is rarely used in HNC and only few studies analyzed the efficacy of this technique in the treatment of oropharyngeal dysfunction following treatment for HNC [2-4]. In none of the previous studies the fat injections were performed under local anesthesia. The latter might assure some important advantages, such as the “functional” display of the operative field since the patient is awake and able to swallow. In addition, the patient is in a sitting position during the surgery and consequently the relationship among swallowing structures is not influenced by gravity. Finally, the use of flexible trans-nasal endoscopy during FFI allows a fat injection tailored to the patient’s needs since it allows to monitor the effect of surgery on swallowing in real-time. In conclusion, the FFI under local anesthesia could be useful in the treatment of chronic dysphagia in selected patients with tissue loss secondary to HNC surgery.
References


