Mandibular lingual release approach: an appropriate approach for total or subtotal glossectomy

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Abstract

Background

We evaluated a new approach for total or subtotal glossectomy—the mandibular lingual release approach (MLRA)—in place of the lip-split approach.

Methods

We retrospectively reviewed 22 patients with advanced oral cancer who had undergone total or subtotal glossectomy between April 2005 and March 2011. The MLRA was used in 15 patients and the lip-split in seven.

Results

The gross complication rate was 31.8% (7/22), 26.7% (4/15) for the MLRA and 42.9% (3/7) for lip-split. The recurrence rate was 40.9% (9/22) and gross survival rate was 68.2% (15/22). The gross speech intelligibility satisfactory (acceptable or good) rate was 56.1% (13/22), 53.3% (8/15) for the MLRA and 71.4% (5/7) for lip-split. The gross swallowing capacity satisfactory rate was 68.2% (15/22), 73.3% (11/15) for the MLRA and 57.1% (4/7) for lip-split.

Conclusion

The MLRA offers improved space and exposure for removing primary tumour, avoids facial scarring and mandibulotomy and enables good chewing and swallowing function.

Introduction

Patients with advanced oral cancer, including that of the tongue, the base of the tongue, the floor of the mouth and other sites, usually require total or subtotal glossectomy, although this surgical option remains controversial. There are two crucial questions to be resolved. The first is how to achieve adequate safe surgical margins and long-term survival. The second is how to improve patients’ quality of life, such as by restoring speech, swallowing and deglutition and avoiding facial scarring. Traditionally, the lip-split approach is the primary option for expanded tongue surgery, but this requires splitting of the lip and/or mandibulotomy, which severely reduces the patient’s quality of life. In this study, with regard to the questions above, we evaluate our experience of a new approach for total or subtotal glossectomy, the mandibular lingual release approach (MLRA).

Patients and methods

Patients

Between April 2005 and March 2011, 22 patients with advanced oral cancer underwent total or subtotal glossectomy at the Sun Yat-Sen University Cancer Center. Eighteen patients were male and four were female. The mean age was 45.8 years (range 15–63 years). According to the 2002 International Union Against Cancer staging criteria, eight cases were T3N0M0, four were T2N1M0, two were T3N1M0, one was T3N2M0, three were T4N0M0, one was T4N1M0 and one was T4N2M0 and the remaining two were recurrences after hemiglossectomy; therefore, they were not TNM staged (Table 1). Before surgery, all patients underwent a thorough examination and the criteria for inclusion in the study were as follows: (1) primary tumour located in the tongue or the floor of the mouth and pathologically diagnosed as malignant disease; (2) preoperative computed tomography (CT) or magnetic resonance imaging (MRI) showed invasion of more than one-half of the tongue tissue by primary tumour; (3) no distant metastasis (including lung, liver, brain, bone) found on preoperative examination and (4) general condition suitable for lengthy surgery.

Surgical technique

Lip-split mandibulotomy approach

This traditional approach for the ablation of extensive malignant tumour in the tongue has many modifications, but we always used the typical technique. First, the lower lip and anterior mandibular labial sulcus are incised, usually in continuity with the neck dissection incision. After incising the skin, mucous membrane and muscle, mandibulotomy is performed in the midline. A lingual sulcus releasing incision is then made to allow the mandible to be swung out.

MLRA

In this technique, an incision is made from the mastoid on one side to that on the other side, usually in continuity with the neck dissection incision (Figure 1). Subplatysmal skin flaps are raised up to the level of the lower border of the mandible. Bilateral level I regional dissection is performed and the suprahyoid muscles of the digastic anterior belly are identified before entering the oral cavity (Figure 2). On the inner aspect of the mandible, the digastic, mylohyoid, geniohyoid, genioglossus, and, in part, the medial pterygoid muscles are carefully detached from the lingual surface of the mandible by subperiosteal...
dissection. In the mouth, an alveolar crest or lingual gingival sulcus incision (depending on the location of the tumour) is made (Figure 3). The floor of the mouth and tongue can then be dropped into the neck (Figure 4), thereby providing access to all parts of the tongue and oropharynx. Resection and reconstruction are then performed under direct vision and palpation (Figure 5). When closing the wound, the digastric muscles on both sides can be sutured with subplatysmal tissue.

**Total and subtotal glossectomy**

Before ablation of primary tumour, all cases first required ipsilateral or bilateral neck dissection. According to the literature, we defined total glossectomy as the resection of more than 90% of oral and oropharyngeal tongue tissue and subtotal glossectomy as the resection of 66.6%–90%. When the mandible was invaded by a tumour, segmental resection with the primary tumour was required; if the tumour had merely spread to the lingual-side periosteum of the mandible, the periosteum only was removed and the mandible retained. All cases in this study required intraoperative frozen sections to pathologically confirm the safety of the margin. There was no pathological evidence of tumour spread to the larynx; therefore, the larynx was preserved in all cases.

**Reconstruction with flap tissue**

In all cases, two teams operated synchronously; one team ablated the primary tumour and performed neck dissection, while the other harvested the flap and reconstructed the oral cavity defect. All patients in this study

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**Table 1** Patient profiles

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M, male; F, female; T, tongue; BT, base of tongue; FM, floor of mouth; TPF, Taxol, DDP and 5-Fu; PBF, DDP, Bleomycin and 5-Fu.
required reconstruction by flap; four
types of flap were used: free flap
including anterolateral thigh (ALT); flap,
radial forearm flap (FAF); vascular
pedicle flap including pectoralis
major myocutaneous flap (PMMF); and
trapezius myocutaneous flap (TMF). Flap size was
determined intraoperatively and depended on the
oral cavity defect (Figures 6 and 7).

Functional evaluation of speech and swallowing
At least 6 months after surgery, a ques-
tionnaire was given to the patients to
investigate their speech and swallowing
function.

Speech was rated on a scale of 1 to
5, according to its understandability
by a speech therapist during conver-
sation. The scores were defined as
follows: 1, speech clearly understood;
2, speech occasionally misunderstood;
3, speech understood only when the
context of the text was known to the
listener; 4, speech occasionally un-
stood and 5, speech not understood at
all. To grade the results and to analyse
the final outcome in relation to other
clinical factors, speech was also clas-
sified more broadly as good (score
1 or 2), acceptable (score 3) or poor
(score 4 or 5).

The Swallowing Ability Scale was
used to assess swallowing capacity. The
scoring system is based on the MTF
classification, in which the method
of food intake (M) is classified and
scored as follows: M5, capacity for
swallowing unlimited (5 points); M4,
capacity for swallowing anything,
but care must be taken to avoid aspiration
(4 points); M3, capacity to eat any-
ting if the food is prepared in a suit-
able form (3 points); M2, capacity to
eat small portions of food, but tube
feeding is the main means of ingestion
(2 points) and M1, tube feeding is
the only method of ingestion
(1 point). We defined a score of 1 or 2 as
good, 3 as acceptable and 4 or 5 as poor.

The time required for food intake
(T) is assessed according to the aver-
age time required to eat a daily meal
(irrespective of its nature and con-
sistency). This parameter is classified
and scored as follows: T5, normal food
intake time, viz. <15 min (5 points);
T4, intake of food requires 15–25 min
(4 points); T3, intake requires 25–35
min (3 points); T2, intake requires
35–45 min (2 points) and T1, intake
requires >50 min or is impossible
(1 point).

The consistency of the food that the
patient is able to ingest (F) is classi-
fied and scored as follows: F5, capa-
city to eat food of any consistency
(5 points); F4, capacity to eat soft,
chewable food such as cooked rice or
cooked vegetables (4 points); F3, capa-
city to eat gruel (3 points); F2, capacity
to swallow viscous fluids (2 points)
and F1, capacity to swallow only non-
viscous fluids (1 point). We defined
swallowing function as the total MTF
score, with 19–15 good, 7 or 8 accept-
able and 3–6 poor.

Results
In our study, 9 of the 22 patients
underwent total glossectomy and 13
underwent subtotal glossectomy. The
pathological diagnoses were 20 squa-
mous cell carcinomas (SCC), 1 adeno-
cystic carcinoma (ACC) and 1 primit-
ive neuroectodermal tumour (PNET).
No patient died during the periopera-
tive period, and no patient underwent
laryngectomy. In all cases, the tongue
defects were reconstructed by flap tis-
uue; 15 were microvascular free-flap
transfers and 7 were vascular pedicle
flap transfer. All flaps survived post-
operatively. The gross complication
rate was 31.8% (7/22), 26.7% (4/15)
for the MLRA and 42.9% (3/7) for the
lip-split approach. Ten patients received
post-operative radiotherapy, with doses
of 66–70 cGy; the average dose was
68 cGy. The follow-up time was 12–72
months. Recurrence was found in nine
patients during the follow-up period;
the recurrence rate was 40.9% (9/22)
[33.3% (5/15) for the MLRA and 57.1%
(4/7) for lip-split]. The recurrent sites
were three local, two neck, two neck/
local and two distant metastasis (lung).
The gross survival rate was 31.8% (7/22); seven patients died during the follow-up period, but only survived for less than one year. All deaths were caused by tumour (Table 2).

Functionally, speech intelligibility was satisfactory (good = 1 or 2) in 56.1% patients (13/22) [60.0% (9/15) for the MLRA and 57.1% (4/7) for lip-split] and swallowing capacity was satisfactory (good = 9–15) in 68.2% patients (15/22) [73.3% (11/15) for the MLRA and 57.1% (4/7) for lip-split]. There were no statistically significant differences in function. No patient needed permanent tube feeding, but 1 of 19 patients required tracheotomy that subsequently could not be decannulated (Table 3).

Case report (No. 10)
A 34-year-old Chinese man experienced pain in the right side of his tongue for about 3 years accompanied by slight swelling of the tongue for about 18 months. At the hospital, oral examination indicated that the patient had limited lingual movement. A lymph node was palpated in the right level II A of the neck; it measured about 20 × 15 mm and was stiff and mobile with a clear border. Preoperative biopsy was performed, and the pathological diagnosis was ACC. MRI showed a tumour in the right side of the tongue measuring 50 × 54 × 46 mm that had infiltrated the floor of the mouth (Figure 8). Chest radiography and abdominal ultrasonography were normal. The patient underwent subtotal glossectomy and total resection of the floor of the mouth and the right lateral wall of the oropharynx using the MLRA (Figure 9), along with ipsilateral modified radical neck dissection and tongue reconstruction using a TMF.

The neck specimen was removed in continuity with the primary tumour using a pull-through approach. The patient received radiation therapy 6 weeks after surgery, with a dose of 68 Gy. The combined-modality treatment was tolerated well. He was followed up for 32 months, without recurrence and metastasis (Table 3).

Table 2: Treatment of patients

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<th>Resection</th>
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TG, total glossectomy; STG, subtotal glossectomy; D, death.
followed-up closely, and he was found to have lung metastasis 2 years after treatment. No further treatment is available for this patient.

Discussion

Traditionally, transoral resection is often possible for early and anterior tongue tumours, but this approach is difficult for deeply infiltrating and posterior cancers. There are four major approaches in this situation. First is the parapharyngeal approach, which is usually employed for small tumours located in the base of the tongue. Second is lip-split mandibulotomy, which is suitable for extensive oral surgery, but causes facial scarring and labial asymmetry. Third is the visor flap; with this approach, it is easy to access the anterior oral cavity, but the mental nerve usually needs to be cut to raise the chin and cheek flap, and this causes labial anesthesia. Fourth is the MLRA, which was first reported by Stanley in 1984. This is a good approach for exposure of the whole tongue, particularly its posterior side.

In the past two decades, treatment of advanced oral cancer with total or subtotal glossectomy has been controversial. This procedure can cause significant morbidity and mortality, resulting in poor quality of life and inevitable functional deficits such as problems with swallowing and loss of speech. Increasingly, head and neck oncologists believe that advanced oral cancer requires multimodality therapy, and surgical resection is the preferred initial modality. The prognosis of resectable cases is better than that of unresectable cases, meaning that, in some patients, extensive ablative surgery, for example, total or subtotal glossectomy can now improve the prognosis of cancers that were previously regarded as unresectable. In the present study, only one patient died less than one year after surgery, showing that surgery can dramatically prolong the survival and free-disease

Table 3 Functional evaluation of patients

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Figure 8: As the No. 10 case patient, the axial section of the MRI showed that the malignant tumour had infiltrated almost the whole tongue (around the white arrows).

Figure 9: The defect of oral cavity after subtotal glossectomy and total resection of the floor of the mouth and the right lateral wall of the oropharynx using the MLRA.
The key to avoiding recurrence following surgical treatment is achieving a safe surgical margin. The standard acceptable criterion is a 1–1.5 cm soft tissue margin around the gross tumour, which is a challenge for head and neck surgeons. Our data showed patients in whom the MLRA was used for total or subtotal glossectomy had a lower recurrence rate (33.3%) than those treated with the lip-split approach (57.1%). One reason for this may be that use of the MLRA enables direct vision and palpation to remove the primary tumour; another resection of the base of the tongue and the oropharynx is easier and safer with the MLRA than with the traditional approach.Conventionally, the lip-split approach is used for tumours located at the base of the tongue (even T2 tumours). In the present study, however, we successfully treated three patients with base of the tongue cancer using the MLRA.

The other controversial issue is the poor quality of life of patients who have undergone total or subtotal glossectomy. Surgical reconstruction plays a crucial role in extended tongue resection, not only to repair the large defect, but also to restore tongue function. Yun et al. reported that correct choice of reconstruction can improve outcome. All patients in the present study underwent auto-flap tissue transplantsations, all of which were successful. Some patients remained able to swallow and speak as usual; our data showed good speech intelligibility in 56.1% (13/22) and satisfactory swallowing in 68.2% (15/22) patients. No patient totally lost his speech or capacity to swallow.

There are various options for the reconstruction of tongue defects; we used four types of flap: two free flaps and two vascular pedicle flaps. There are no significant differences in the use of different flaps; selection criteria depend on the condition of the individual and the preferences of the institute. Kimata et al. indicated that using a flap of sufficient volume is associated with good function; PMMFs and ALTs are usually suitable for this purpose, but precise closing of defects in the oral cavity is difficult using a bulk flap. We found that use of the MLRA creates obstacle-free access for reconstruction, especially when closing oropharyngeal and hypopharyngeal defects (Figure 11). Thus, restoration of function may be improved in patients treated with the MLRA.

Compared with the lip-split approach, the MLRA has two other advantages. First, it provides a good aesthetic outcome; there is no facial scarring; therefore, patients are happier to participate in social activities. Second, using the MLRA avoids mandibulotomy, which is good for patients who receive post-operative radiotherapy, because mandibulotomy can increase the risk of osteoradionecrosis. Merrick et al. suggested that accurate repositioning and permanent fixation of the genioglossus, geniohyoid and digastric muscles will improve outcomes in terms of speech, chewing and swallowing, but this requires a small osteotomy of the anterior mandible. Our experience shows that this is unnecessary because, after total or subtotal glossectomy, there are only few or no intrinsic lingual muscles attached to the residual tongue, and it would be difficult to reposition the extrinsic lingual muscles to provide tongue movement. Generally, only the digastric muscle could be reused, and we usually reattach this with subplatysmal tissue and improve the floor of the mouth. The genioglossus and geniohyoid muscles are always close to the primary tumour, and thus need to be detached from the mandible and mostly removed; the muscles then contract and would be difficult to reattach. Moreover, osteotomy is disadvantageous to patients who require post-operative radiotherapy because it increases the risk of osteomyelitis; as a consequence, we do not recommend using this method to improve tongue function.

We searched the current medical literature and found only a few studies reporting use of the MLRA for oral cavity tumour treatment, and only we have used it for total or subtotal glossectomy. Given the advantages...
discussed above, we strongly recommend the MLRA as an appropriate approach for total or subtotal glossectomy. Treatment of patients with advanced oral cancer remains a challenge for head and neck oncologists. Use of the MLRA for total or subtotal glossectomy provides convenient access for surgery and ensures the success of the procedure, but cannot bring about any essential change to the survival of patients with advanced oral cancer. Such treatment requires a multidisciplinary approach combining surgery with radiotherapy and chemotherapy. Humanized monoclonal antibodies targeted against the epidermal growth factor receptor, such as cetuximab, are promising agents combined with cisplatin-based chemotherapy and radiotherapy for high-risk advanced oral cancer.23,24 We believe that effective surgical treatment can contribute to the survival of these patients combined with new treatment strategies.

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References