

## Surgical management of the plunging ranula: a review of seven cases

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### Abstract

We have treated seven patients with a plunging ranula during the past 10 years. All patients underwent surgery via a cervical approach. In two, the ranula reached the anterior neck by passing through a dehiscence in the mylohyoid muscle, while in the other five the plunging ranula passed posteriorly to the mylohyoid muscle. A pseudocyst was extirpated in each patient. Although total sublingual gland excision was not performed in two patients, no recurrence was observed in any patient. Incision of the pseudocyst facilitated subsequent procedures and decreased the incidence of transient facial paralysis. In the presence of a cervical mass without swelling of the oral floor, a cervical approach may still be the method of choice either for the first operation or for salvage surgery after recurrence subsequent to intraoral procedures. It is based on the fact that there may be ectopic sublingual glands residing on the inferior surface of the mylohyoid muscle.

**Key words:** Ranula; Sublingual gland; Mouth floor

### Introduction

The terms plunging ranula or cervical ranula refer to those that extend beyond the sublingual space and involves the submandibular space and adjacent structures. Patients with a plunging ranula usually complain of a soft cystic mass in the anterior neck. Because a correct pre-operative diagnosis of plunging ranula is often difficult, patients usually undergo surgical excision of the cystic mass for both correct diagnosis and therapy. Over the past 10 years, we have treated seven patients with a plunging ranula at the University of Tokyo Hospital and Tokyo Metropolitan Fuchu Hospital. Although recent reports (Whitelock and Summersgill, 1962; Roediger and Kay, 1977; van den Akker *et al.*, 1978; de Visscher *et al.*, 1989) indicate that intraoral excision of the sublingual gland (SLG) with oral drainage of the cervical cyst is adequate treatment, we approached the lesions via a neck incision and concurrently dissected out the pseudocyst in each case. We present a review of seven cases and discuss the indications of the cervical and oral approaches.

### Materials and methods

At the Department of Otolaryngology, University of Tokyo Hospital, we have identified 92 mass lesions in the submandibular triangle between

August 1985 and July 1995. Four of these lesions were identified as having a plunging ranula. Three additional patients with a plunging ranula underwent surgery by the first author between April 1985 and April 1988 at Tokyo Metropolitan Fuchu Hospital. Here we review a total of seven patients.

### Results

Demographic data are summarized in Table I. Four of the patients were men, and three were women. Their average age was 21.5 years. Presentation was most common in the second decade of life, with a range of three to 42 years. Infection and trauma played no aetiological role in six of the histories. In one case, a plunging ranula developed five months after surgery for a thyroglossal duct cyst. The left side was affected in two cases and the right in five. The duration of symptoms before consultation ranged from two to 22 months, but was less than six months in five cases. The presence of swelling in the floor of the mouth was recognized in only three cases. Six cases were correctly diagnosed pre-operatively. The diagnosis in the other case was recurrence of a thyroglossal duct cyst. All patients with a plunging ranula underwent surgery via the cervical approach. Each operation was performed by a different surgeon, apart from the three cases

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TABLE I  
CLINICAL CHARACTERISTICS OF PATIENTS WITH PLUNGING RANULA

Case	1	2	3	4	5	6	7
Age/Sex	30/F	3/M	14/M	42/F	14/M	14/F	34/M
Side	L	L	R	R	R	R	R
Duration of symptoms	18 Months	4 Months	2 Months	3 Months	6 Months	5 Months	22 Months
Size (mm)	50 X 30	25 X 20	50 X 25	30 X 30	40 X 25	50 X 25	60 X 60
Sublingual swelling	+	--	+	-	-	-	+
Pre-operation diagnosis	PR	recurrent TGDC	PR	PR	PR	PR	PR
Date of surgery	85.6.17	86.4.2	88.2.17	88.3.30	90.3.14	94.8.17	95.7.12
Route of entry	post	dehis	post	post	post	dehis	post
MMB identification	+	-	+	+	+	+	+
Resection of SLG	total	subtotal	total	total	subtotal	total	total
Transient Palsy of MMB	+	-	+	-	-	+	+

M: male, F: female, L: left, R: right, PR: plunging ranula, TGDC: thyroglossal duct cyst, post: posterior to the mylohyoid muscle, dehis: through the dehiscence of the mylohyoid muscle, MMB: marginal mandibular branch of the facial nerve, SLG: sublingual gland.

treated by the first author. The plunging ranula reached the neck by two routes, in two patients, by passing through a dehiscence in the mylohyoid muscle, while in the other patients it passed posterior to the mylohyoid muscle. A pseudocyst was extirpated in each case, but total excision of the SLG was not performed in two cases because the surgeons did not appreciate the importance of total excision. Fortunately, there has been no evidence of recurrence in any patient, including the two who underwent subtotal resection. Transient paralysis of the marginal mandibular branch of the facial nerve occurred in four patients. In all of these, the branch was identified superficially on the ballooning pseudocyst during surgery. All signs and symptoms of paralysis resolved within three months. In two cases, the cyst was incised after identifying the marginal mandibular branch on its surface, and its contents were evacuated. With this procedure, dissection of the mandibular branch could be avoided, and post-operative paralysis did not develop.

## Discussion

At present there is no doubt that a plunging ranula is derived from extravasation of salivary secretions from the SLG and retention of saliva with extension to the neighbouring spaces. In contrast to the parotid and submandibular glands, which secrete after major stimuli such as eating, the SLG secretes continuously during the interdigestive period. According to Harrison and Garrett (1972) and de Visscher *et al.* (1989), mucous extravasation develops due to obstruction in the salivary ducts and the resultant rupture of the acini, which are apparently less resistant to the rapid increase in luminal pressure from the continuing secretion. Thus, anomalies of the salivary ducts or potential causes of their obstruction, such as trauma and infection, have been indicated as prerequisites for the development of a ranula. A review of the literature disclosed that in 44 per cent of cases a plunging ranula was iatrogenic, occurring after attempts at removing an oral ranula (Bridger *et al.*, 1989). Without total excision of the SLG during the operation for oral ranula, the newly extravasated saliva cannot be accommodated in the oral compartment because of post-operative scarring in the floor of the mouth. The

saliva is thus forced into the neck through the weakest area between the sublingual space and the submandibular space. Infection and trauma were not obvious causal features in most of the case histories reported so far (Bridger *et al.*, 1989). The situation was the same in this study. We had only one case (Case 2) in which a plunging ranula developed post-operatively. The patient had undergone Sistrunk's operation for a thyroglossal duct cyst, not for an oral ranula. It is unlikely that the SLG or ducts were damaged during this operation. Thus, the ranula might have been congenital and independent from the first lesion.

The mylohyoid muscle is regarded as a diaphragm of the oral floor, but it is not a strict anatomical barrier. The pathway of mucous extravasation may be along the deep lobe of the submandibular gland to exit posteriorly between the hyoglossus and mylohyoid muscles, or directly through a dehiscence in the mylohyoid muscle itself (Mair *et al.*, 1979; Bridger *et al.*, 1989). According to Gaughran (1963), it was Forget in 1870 who suggested the existence of a hiatus in the mylohyoid muscle to explain the anatomical continuity between a sublingual ranula and a suprahyoid cyst. Cadaver studies reported the incidence of dehiscence or hiatus in the mylohyoid muscle to be between 36 per cent (Gaughran, 1963) and 45 per cent (Engel *et al.*, 1987). All dehiscences were located in the anterior two-thirds of the muscle, more frequently on its lateral side.

With regard to the intraoral appearance of the masses in patients with a plunging ranula, 45 per cent presented first with an oral swelling, 34 per cent had an associated oral mass at presentation, and 21 per cent had only a swelling in the neck (Langlois and Kolhe, 1992). A possible explanation for the absence of swelling in the floor of the mouth was provided by the frequent presence of processes of the SLG projecting through the dehiscence in the mylohyoid muscle. Herniated projections of the SLG through the perforations showed an incidence varying from 10 per cent (Castelli *et al.*, 1969), to 45 per cent (Engel *et al.*, 1987), and they may permit mucous extravasation only in the neck. Furthermore, there has been a case report of a plunging ranula due to an ectopic SLG located below the mylohyoid muscle (Braun and Sotereanos, 1982). This is another

explanation for the occurrence of a plunging ranula without an oral lesion.

The pre-operative diagnosis of a plunging ranula is often precluded by the absence of visible intraoral components and no comprehensive diagnostic studies are available. However, a strong suspicion of a plunging ranula is suggested by the presence of a cervical swelling likely to be sublingual in origin, or by a history of a tumour, whose size gradually increases but fluctuates in association with very thick mucus on needle aspiration. In both instances, however, diagnostic reliability is limited. Analysis of the cyst fluid of a plunging ranula shows high levels of salivary amylase and protein, similar to secretions of the SLG. Computed tomography (CT) scans and magnetic resonance (MR) imaging can provide accurate localization of the mass and help narrow the range of diagnostic possibilities. In CT and MR scans, a plunging ranula is characteristically a cystic mass in the submandibular space that extends into or abuts the sublingual space (tail sign).

A variety of procedures have been proposed for treatment because a plunging ranula may recur after simple excision or marsupialization. On the basis of the genesis of the cyst, treatment should be directed towards the secretory tissue giving rise to the ranula. Thus, excision of the SLG seems the most reasonable treatment. Intraoral excision of the SLG with oral drainage or aspiration of the contents of the cervical cyst may suffice for cure and is now regarded as a method of choice. However, when faced with a cystic swelling in the neck, it is tempting to excise the cyst completely. Meticulous dissection and removal of the entire cyst lining is still claimed as essential for successful management (Gaughran, 1963; Khafif *et al.*, 1975; Quick and Lowell, 1977). To remove the cyst *en bloc*, a cervical approach is preferred because significant cervical extension may be difficult to mobilize through a limited oral incision. All patients in this study underwent surgery via the cervical approach. However, the incidence of paralysis of the marginal mandibular branch of the facial nerve was very high, although it was transient. The frequent occurrence of paralysis might be due to dissection of the nerve from the surface of the ballooning cyst without rupture of the cyst wall. However, complete dissection of the cyst is unnecessary because the pseudocyst lacks an epithelial lining, and its wall consists of an encapsulating thin layer of fibrous tissue that forms in response to extravasated mucus. Thus, to reduce the incidence of lower lip paralysis, we incised the cyst wall first and evacuated its contents soon after identifying the branch on the surface of the cyst in two cases. With this procedure, dissection of the marginal mandibular branch could be avoided, and post-operative paralysis did not develop. The cervical approach also provides access to the SLG in the sublingual space, when adequate exposure of this space is achieved by raising the mylohyoid muscle anterosuperiorly. Excision of the submandibular gland and incision of the cyst facilitates this exposure.

We are not reluctant to perform simple excision of

the SLG and drainage of the cyst contents via an oral approach in cases of plunging ranula. However, when there is a soft anterior neck swelling without oral swelling, diagnosis is still difficult. Furthermore, even if a diagnosis of a plunging ranula is strongly suggested on the basis of an analysis of the cyst contents and the results of modern diagnostic imaging procedures, the presence of ectopic SLGs on the undersurface of the mylohyoid muscle cannot be ruled out, although they are fairly uncommon. In such patients, it is far easier to access these gland(s) via a cervical approach. Thus, the cervical approach still seems to be the method of choice in cases of plunging ranula without oral swelling either for the first operation or for salvage surgery for the recurrence after intraoral procedures.

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