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Long-Term Outcome After Intraoral Removal of Large Submandibular Gland Calculi

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Objectives/Hypothesis: To evaluate the long-term outcome of intraoral removal of large submandibular gland calculi.

Study Design: Retrospective cohort study.

Methods: A retrospective review (1995–2008) of 118 patients with submandibular calculi ≥10 mm treated by intraoral surgical removal with preservation of the salivary gland.

Results: Calculi were completely removed in 103/118 (87.3%) cases, partially removed in 14/118 (11.9%), with failure to remove any fragments in only 1/118 (0.8%). After a mean follow-up of 42 months, 101/118 (85.6%) cases remained asymptomatic, 17/118 (14.4%) cases had modest obstructive or infective symptoms, 4/118 (3.4%) cases suffered recurrent stones, and in 1/118 (0.8%) case persistent symptoms dictated salivary gland removal.

Conclusions: The data suggest that the majority of large submandibular gland calculi can be removed by gland-preserving procedures retaining an asymptomatic salivary gland. This casts doubt on the commonly held premise that salivary stones normally lead to chronic sialoadenitis, which is the basis for the current policy of sialoadenectomy.

Key Words: Large calculi, submandibular gland, long-term outcome.

Level of Evidence: 2C.

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INTRODUCTION

Sialolithiasis is the most common cause of both obstruction and sialoadenitis.[1] The typical presentation is of a painful swelling of the gland at meal times when the gland auto inflates with obstructed saliva. The incidence of symptomatic salivary calculi is reported to be about 59 cases per million per year in the United Kingdom,[2] which implies a prevalence of 0.45% assuming a lifetime of 76 years.[3] Some 80% to 90% of calculi are found in the submandibular gland.[4]

Traditionally, the treatment for calculi in the proximal duct or gland has been sialoadenectomy. The main rationale determining surgical policy is the widely held view that proximal stones cause permanent structural damage to the gland, which in turn are predisposed to recurrent infection.[5] It is assumed the damage incurred by the gland is proportional to the size of the stone, which in turn is related to its duration of residence in the gland. Conservative treatment measures less radical than sialoadenectomy are thought to only postpone gland excision.

The purpose of this study is to describe our experience in treating large submandibular calculi by gland-preserving techniques.

MATERIALS AND METHODS

A retrospective review was undertaken of patients with submandibular sialoliths treated by minimally invasive gland-preserving surgery in the Department of Oral and Maxillofacial Surgery, King's College London and the Department of Otorhinolaryngology, University of Milan in the period from 1995 to 2008.

The collective policy was to treat all symptomatic salivary calculi by minimally invasive methods and only undertake adenectomy as a last resort. Patients underwent clinical and ultrasonographic and/or sialographic examination. Demographic details, including gender, location, number of stones, and stone size were recorded prospectively in the medical records and are summarized in Table I. Only patients with submandibular stones ≥10 mm were included in the study.

In theory, the treatment available included lithotripsy, basket retrieval, or intraoral surgery. However, in practice, the first two are not applicable for large stones,[6] and therefore, the calculi were treated exclusively by intraoral, endoscope-assisted surgery. The surgical technique was standardized between the two units and has been reported previously.[7] In brief, an oblique incision is made from the punctum of the submandibular duct along the floor of the mouth toward the third molar tooth. The sublingual gland is mobilized and retracted to expose the

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TABLE I.
Study Group Parameters for Intraoral Surgical Removal of Submandibular Calculi.

Parameter	No.	%
Male	71	60.2
Female	47	39.8
Mealtime syndrome	109	92.4
One or more episodes of acute sialoadenitis	85	72.0
Multiple calculi (2–6)	7	5.9
Ductal position		
Mid-third	1	0.8
Proximal third	37	31.4
Hilum	79	67.0
Intraglandular	1	0.8
	Mean	Range
Age (yr)	54	15–85
Duration of obstructive symptoms (mo)	26	2–600
Stone size (mm)	13.4	10–40

submandibular duct. This structure is then followed to the hilum of the gland, where the stone is delivered through an incision in the duct wall. The duct is irrigated with normal saline and closed with fine resorbable sutures. Endoscopic examination confirms the removal of the calculus and debris postextraction.

After 48 hours, the patients were advised to massage the gland and ensure a constant flow of saliva with sialagogues, such as sugar-free gum. Patients were reviewed at 1 week, 3 months, and yearly thereafter. For the purpose of the study, patients were reviewed by postal questionnaire.

RESULTS

In the period from 1995 to 2008, 118 patients with submandibular calculi $\geq$10 mm were identified for gland-preserving treatment. In this group, 17 cases had previously undergone unsuccessful minimally invasive attempts to remove the stones.

Stones were successfully retrieved in 103/118 patients (87.3%) and partially removed in 14/118 (11.9%). The one instance in which surgery failed (1/118, 0.8%) was where the stone lay in the parenchyma of the submandibular gland (Table II).

Immediate postoperative complications included: swelling in 97/118 (82.2%) cases and temporary lingual nerve paresthesia in 18/118 (15.3%). Altered sensation persisted in 5/118 (4.2%) at 6 months postoperatively. There was no incidence of hemorrhage or ranula formation in this cohort of patients.

After a mean follow-up of 42 months (range, 5–84 months), 101/118 (85.6%) patients remained asymptomatic and 17/118 (14.4%) had mild obstructed or infective symptoms (Table II), of which four patients (3.4%) had developed new stones. In this latter group (n = 17), the new symptoms were eliminated in 12 cases by subsequent minimally invasive therapy (lithotripsy or basket retrieval). The patient with a parenchyma stone underwent sialoadenectomy, and the remaining patients (4/118, 3.4%) accepted the modest residual discomfort without requesting further treatment.

DISCUSSION

Approximately 3,700 patients in the United Kingdom are admitted to the hospital annually with salivary gland obstruction or infection.[2] Of these, an estimated 2,000 patients undergo sialoadenectomy. This surgery has an associated small but significant morbidity both neurological[8] and non-neurological.[8] A minimally invasive approach preserves the gland and largely avoids this morbidity.[6,9]

The exact etiology and pathogenesis of salivary calculi is largely unknown.[3] However, it seems that calculi result from the deposition of calcium salts around an organic nidus consisting of altered salivary mucins.[4,10] Salivary stones can reside silently within the gland for many years. In an analysis of 4,600 salivary stones, the mean delay between initiation of symptoms and presentation for treatment was approximately 5.4 years.[9] The mean size of submandibular stones in this series was 7.2 mm.[9]

It is commonly held that the longer a stone resides in the gland, the more damage is incurred and the greater the risk of persistent sialoadenitis. If this hypothesis is correct, then the risk of recurrent infection following stone removal should be greatest in glands harboring large stones. The current data show that after a mean follow-up of 42 months, only 14.4% (17/118) of patients had recurrent symptoms. A second course of minimally invasive therapy cured a further 10.2% (12/118). The majority remain asymptomatic, and only one patient with an parenchymal stone underwent adenectomy as the final treatment option.

In this series, 4.2% (5/118) of patients had altered lingual nerve function at 6-months postsurgery. These were traction injuries incurred in gaining access to the large and deeply positioned stone. The patients describe a subtle change in perception, and touch and pressure are perceived as normal.

In the last decade the treatment of salivary gland stones has changed from gland extirpation to gland-preserving surgery using minimally invasive techniques.[9] An important principle that supports the move away from sialoadenectomy is that secretory function can recover after removal of the obstruction. Animal studies have shown that cell death is uncommon after ligation of the main salivary duct, and the gland structure returns to normal when the ligature is removed.[11–13]

TABLE II.
Immediate and Long-Term Outcome of Intraoral Surgical Removal of Submandibular Calculi.

	Follow-Up	
Outcome (N=118)	Immediate (%)	Long-Term (%) [Mean, 42 mo; Range, 5–84 mo]
Stone-free	103 (87.3)	101 (85.6)
Residual stone/symptoms	14 (11.9)	16 (13.6)
Failure	1 (0.8)	1 (0.8)

Also, scintigraphic, sialographic, and echostructural appearance of the glands in humans can recover after stone eradication (although it may not always return to normal), consistent with recovery of function.[14–18] Scintigraphic evaluation showed that all of the glands affected by sialolithiasis had reduced function; however, this can improve after removal of the calculus,[14,15,17,18] although the degree of recovery is inversely proportional to the size of the stone.[17]

Although objective evaluation of glandular function was absent in this study, data showed that the majority of patients were symptom-free 2 years after stone release. Only a small number had recurrent symptoms, and an even smaller proportion developed new calculi. In what would be considered a poor prognosis group, 85.6% (101/118) of patients preserved their salivary gland and remain asymptomatic. The suggestion that salivary glands affected by large stones are destined for a natural history of sialadenitis and eventual gland removal has not been borne out in the short term. The data support the continuation of a minimally invasive approach to the management of salivary calculi.

CONCLUSION

The study data support the continuation of a minimally invasive approach to the management of salivary calculi.

BIBLIOGRAPHY

1. Ngu RK, Brown JE, Whaites EJ, Drage NA, Ng SY, Makdissi J. Salivary duct strictures: nature and incidence in benign salivary obstruction. *Dentomaxillofacial Radiol* 2007;36:636–637.
2. Escudier MP, McGurk M. Symptomatic sialoadenitis and sialolithiasis in the English population, an estimate of the cost of hospital treatment. *Br Dent J* 1999;186:463–466.
3. Escudier MP. Aetiology and epidemiology of salivary calculi. In: McGurk M, Renehan A, eds. *Controversies in Salivary Gland Disease*. Oxford, UK: Oxford University Press; 2001:249–255.
4. Lustmann J, Regev E, Melamed Y. Sialolithiasis. A survey on 245 patients and a review of the literature. *Int J Oral Maxillofac Surg* 1990;19:135–138.
5. Bates D, O'Brien CJ, Tikaram K, Painter DM. Parotid and submandibular sialadenitis treated by salivary gland excision. *Aust N Z J Surg* 1998;68:120–124.
6. McGurk M, Makdissi J, Brown JE. Intra-oral removal of stones from the hilum of the submandibular gland: report of technique and morbidity. *Int J Oral Maxillofac Surg* 2004;33:683–686.
7. Gallo O, Berloco P, Bruschini L. Treatment for non-neoplastic disease of the submandibular gland. In: McGurk M,Renehan A, eds. *Controversies in Salivary Gland Disease*. Oxford, UK: Oxford University Press; 2001:297–303.
8. McGurk M, Escudier MP, Brown JE. Modern management of salivary calculi. *Br J Surg* 2005;92:107–112.
9. Iro H, Zenk J, Escudier M, et al. Outcome of minimally invasive management of salivary calculi in 4,691 patients. *Laryngoscope* 2009;119:263–268.
10. Bodner L. Salivary gland calculi: diagnostic imaging and surgical management. *Compendium* 1993;14:572,574–576.
11. Tamarin A. Submaxillary gland recovery from obstruction I. Overall changes and electron microscopic alterations of granular duct cells. *J Ultrastruct Res* 1971;34:276–287.
12. Tamarin A. Submaxillary gland recovery from obstruction II. Electron microscopic alterations of acinar cells. *J Ultrastruct Res* 1971;34:288–302.
13. Osailan SM, Proctor GB, Carpenter GH, Paterson KL, McGurk M. Recovery of rat submandibular salivary gland function following removal of obstruction: a sialometrical and sialochemical study. *Int J Exp Pathol* 2006; 87:411–423.
14. Nishi M, Mimura T, Marutani K, Noikura T. Evaluation of submandibular gland function by sialo-scintigraphy following sialolithectomy. *J Oral Maxillofac Surg* 1987;45: 567–571.
15. Yoshimura Y, Morishita T, Sugihara T. Salivary gland function after sialolithiasis: scintigraphic examination of submandibular glands with 99mTc-pertechnetate. *J Oral Maxillofac Surg* 1989;47:704–711.
16. Capaccio P, Ottaviani F, Manzo R, Schindler A, Cesana B. Extracorporeal lithotripsy for salivary calculi: a long-term clinical experience. *Laryngoscope* 2004;114:1069–1073.
17. Makdissi J, Escudier MP, Brown JE, Osailan S, Drage N, McGurk M. Glandular function after intraoral removal of salivary calculi from the hilum of the submandibular gland. *Br J Oral Maxillofac Surg* 2004;42:538–541.
18. Roh JL, Park CI. Transoral removal of submandibular hilar stone and sialodochoplasty. *Otolaryngol Head Neck Surg* 2008;139:235–239.