Salivary Gland Obstruction, Changing Patterns of Practice

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Mark McGurk has acted as an adviser to Storz on the design of sialoendoscopes. He has received four samples for evaluation over the last five years.

Embryologically the salivary glands form an integral part of the gastrointestinal tract and so it is not surprising that these glands are subject to some of the diseases and disorders that afflict the intestinal system. In clinical practice the common disorders fall into three main categories, the first being inflammatory disorders of autoimmune origin, notably Sjögren's disease, and associated conditions such as mucosa-associated lymphoid tissue (MALT) lymphoma. The second group are salivary gland tumours. Malignant disease is uncommon with an incidence of approximately 7-10 cases per million population per annum. If benign tumours, such as Warthin's and pleomorphic adenoma are included, then the incidence rises to 80 cases per million per annum.

The third group includes the obstructive disorders of salivary glands, which account for approximately half of major salivary gland disease.[1] The data suggests the risk of encountering a salivary stone in a lifetime is about 0.5%. Hospital admissions data indicate that symptomatic obstructive salivary disease is responsible for the hospital admission (average of three days) of about 60 patients per million annually.[2] This is the area of clinical practice in which significant advances in management have been made in recent years. The object has been to move treatment towards less invasive procedures, ideally on an ambulatory basis in outpatients or as day case surgery, with preservation of a functional gland.

Data based on 400 patients with salivary calculi suggests the natural history of the condition is protracted with symptoms of mealtime syndromes present for about five years before the patient seeks advice.[3] The typical history is of intermittent obstruction interspersed with periods of normal function that may span months or years. Normally patients present when the obstruction converts to sub-acute sialadenitis. Stones in the distal portion of a salivary duct near to the

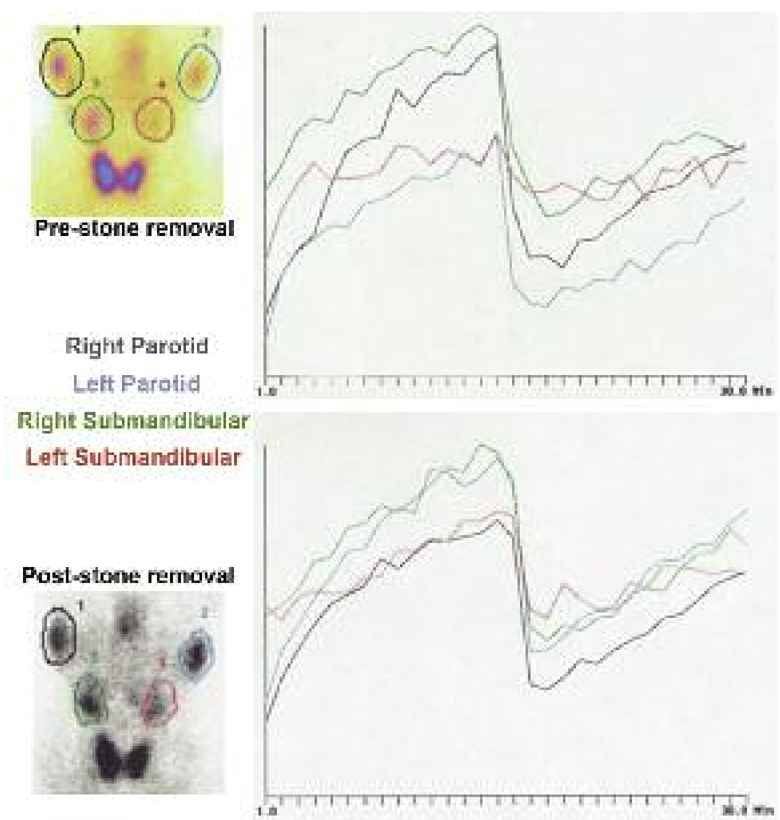

Figure 1: Technecium scintiscans pre- and post-stone removal from left submandibular gland (red line) with improved function of the left submandibular gland following stone removal. In the pretreatment scan there is a steady level of emission from the affected gland, indicating failure of production of saliva on administering a sialogogue at 15 minutes. In the post-treatment scan the emission level from the gland decreases following administration of sialogogue indicating improved gland function and saliva production.

Table 1: Management protocol

STONE SIZE AND LOCATION	1ST LINE TREATMENT	SUCCESS RATE
SMALL (<4mm) MOBILE STONE ANY GLAND	BASKET RETRIEVAL (radiological guidance or endoscopy)	SUCCCESSFUL RETRIEVAL >70%
>4mm SUBMANDIBULAR	ENDOSCOPE GUIDED SURGERY	99%
>4mm, <8mm PAROTID	EXTRACORPOREAL LITHOTRIPSY	STONE CLEARANCE 60%
>8mm OR PERSISTENT PAROTID STONES	ENDOSCOPE GUIDED SURGERY	95%

punctum are easy to remove surgically and fall outside the scope of the present article. Stones in the middle and proximal duct are more difficult to access via an intra-oral approach and the universal approach has been salivary adenectomy, on the presumption that chronic obstruction and repeated episodes of sialadenitis had caused irreversible damage to the salivary gland. However, our experience indicates that the majority of glands remain asymptomatic following stone removal; animal studies have shown initial atrophy due to prolonged obstruction with a propensity for gland regeneration following release of obstruction.[4] Also scintigraphy studies of salivary excretion have demonstrated that gland function improves following stone removal (Figure 1).[5] This premise underpins the philosophy behind minimally invasive stone removal. The introduction of minimally invasive techniques has been facilitated by the development of miniaturised instruments, complemented by a change in attitude of the surgical team, enforced strongly by patient pressure towards gland preserving surgery.

Introduction of minimally invasive therapy

Minimally invasive treatment of stones was first embraced by urologists in the early 1980s for the management of kidney stones. Rudimentary lithotripters were introduced into clinical practice and were a far cry from the sophisticated third generation machines of today. At about the same time there was a rapid advancement in endoscopic technology and an upsurge in interest in laser treatment. The combination of these events meant that by the late 1990s the urologists had changed the standard of practice towards minimally invasive methods, and away from open surgery. The transfer of knowledge to the management of salivary calculi was dependent on miniaturisation of the instruments.

Salivary extracorporeal lithotripsy

Extracorporeal lithotripsy can be provided by the Storz minilith machine or the Wolfe piezo electric abdominal lithotripter. The latter, as the name indicates, was not designed for use in the head and neck and the ultrasound targeting system is not particularly sensitive to small salivary calculi. The machine of choice is the Storz sialolith. It is important when targeting objects in the head and neck that pressure waves are tightly focused on the stone. A large shockwave focus will engage local structure and although not dangerous, the shockwave irritates the periosteum and makes the procedure acutely painful. Properly targeted, lithotripsy is usually uncomfortable but not painful.

It is important when targeting objects in the head and neck that pressure waves are tightly focused on the stone

Initially the extracorporeal lithotripter was used for large and small, fixed as well as mobile stones, both in the parotid and submandibular gland. Over a period of time it slowly became apparent that shockwave lithotripsy was not effective in all situations. This experience has been mirrored in five centres specialising in minimally invasive treatment (Milan, Paris, Erlanger, London, Israel). The independent factor predicting for clearance of the calculus is stone size. A stone over 8mm has less than a 10% chance of clearance. Also it is apparent the lithotripter is more efficient in targeting parotid than submandibular stones (60% clearance versus 30% clearance). Consequently there has been a change in treatment policy. Lithotripsy is now reserved for parotid stones >4 and <8mm diameter. Of the remaining cases (40% with retained stone product), 30% are asymptomatic, and a wait and see policy is adopted; 10% have recurrent infections and require further intervention (see endoscopic assisted surgery).

Basket retrieval of stones

By the end of 1990s microendoscopes (outer diameter 1-1.1mm) were commercially available (Storz and Polydiagnost) together with a range of different dormia baskets. The advent of these tools provided the opportunity to repeat the success achieved in the renal system in the more restricted environment of the salivary glands. Currently there is a wide choice of baskets provided by Cook, Polydiagnost, Boston Scientific and Storz. They vary from 3 to 12 wire constructions; Cook produces a very useful design whereby the end of the basket is blunted. Usually for a basket to engage a stone it has to be advanced past the calculus, the basket opened and then withdrawn to capture the stone for retrieval (Figure 2). If the stone is in the hilum of the gland, it is not possible to advance the basket past the stone. The Cook design does not have to be advanced past the stone but can be opened adjacent to the calculus within a closed cavity.

Case selection is important, for once the basket is engaged it cannot be released. Therefore a prerequisite is that the stone

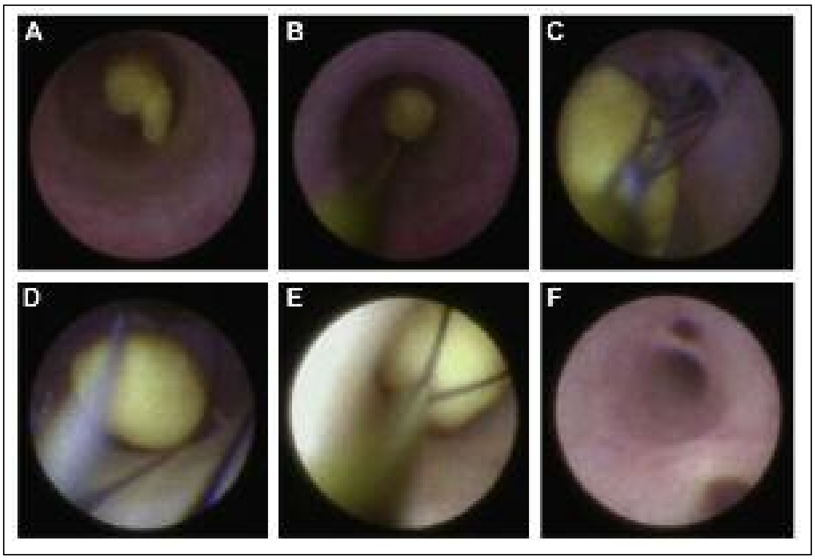

Figure 2: Salivary gland stone removal using a dormia basket under endoscope guidance. A: Stone viewed via the endoscope; B: Closed basket passed beyond the stone; C: Opening of the basket beyond the stone; D: Capture of the stone within the basket; E: Withdrawal of the captured stone within the closed basket; F: Clear ducts following stone removal.

must be mobile and not so large that it cannot be retrieved down the duct lumen. The optimal size is <4mm in diameter, and there should be no stricture within the duct that would impede retrieval of the stone. All these factors can be discerned through a sialogram as a mobile stone is flushed backwards and forwards along the duct and strictures are readily visible. A basket can be introduced under radiological control or by direct vision using an endoscope. In the subgroup of patients with small mobile stones the retrieval rate is approximately 70% (submandibular and/or parotid). The remaining 30% of stones are eliminated by other modalities such as lithotripsy or gland preserving surgery.[6]

Modified surgical techniques for salivary gland stone removal

As the primary modality of treatment, surgery is reserved for fixed and / or large (>4mm) submandibular stones in the middle or proximal portion of the duct. It is also used for the 10% of patients with symptomatic parotid stones that have failed to respond to lithotripsy. The technique for submandibular stones involves an incision through the mucosa of the floor of mouth and blunt dissection to trace the submandibular duct back to the hilum of the gland.[7,8] At this point the stone is identified and released with a small incision made through the duct wall. Retrieval rate is high (99%) and can be undertaken under local anaesthetic in a few suitable patients, but more commonly as a day case procedure under general anaesthetic. The endoscope is used to visualise the duct and to ensure all stones are retrieved from the lumen.

In the parotid, the endoscope is introduced into the duct to visualise the stone; usually a traditional preauricular flap is raised to expose the parotid gland. At this point the similarity with traditional surgery ceases.[8,9] The light at the end of the endoscope is used as a beacon to direct the surgeon on to the duct. The latter is skeletalised and the light source directs the surgeon onto the stone. The latter is released by a small incision through the duct which is subsequently closed and the defect sealed underneath the parotid fascia. Retrieval rates are excellent (95%).

Efficacy of combined gland-preserving techniques for management of salivary calculi

Clinical experience from over 400 cases of salivary calculi in the middle and proximal portion of the duct indicates that in the majority of cases (80%+) the stones can be retrieved leaving a functional gland in situ.[3] The mean follow-up for this group is about five years. The evaluation of salivary function in a subgroup of patients indicates that the glands do recover function following the removal of obstruction although it does not return to the level exhibited in the contra-lateral gland. However, in terms of clinical management the affected gland remains asymptomatic in all but 5% of cases.

Summary

The management of salivary gland calculi has evolved over the last 20 years from adenectomy, initially with the introduction of extracorporeal lithotripsy, then to a broad and more effective choice of techniques. The key is not to rely on any one technique in isolation but use them in combination; if lithotripsy fails to completely eradicate a stone the remaining fragments may be retrieved by a basket. Similarly if basket retrieval is unsuccessful as first line treatment then the stone may be mobilised or moved by the lithotripter. The five centres that have pioneered the minimally invasive salivary therapy have independently come to a similar management protocol.[3,9,11]

Their collective results in a series of 4,600 patients demonstrate stone clearance rates of 80+% and an adenectomy rate of 3%. ■

References

1. Epker BN. Obstructive and inflammatory diseases of the major salivary glands. *Oral Surg Oral Med Oral Pathol* 1972;**33(1)**:2-27.
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(9)**:463-6.
3. McGurk M, Escudier MP, Brown JE. Modern management of salivary calculi. *Br J Surg* 2005;**92(1)**:107-12.
4. 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(6)**:411-23.
5. 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(6)**:538-41.
6. Brown JE. Interventional sialography and minimally invasive techniques in benign salivary gland obstruction. *Semin Ultrasound CT MR* 2006;**27(6)**:465-75.
7. McGurk M, Makdissi J and 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(7)**:683-6.
8. McGurk M, Escudier MP, Thomas BL, Brown JE. A revolution in the management of obstructive salivary gland disease. *Dent Update* 2006;**33(1)**:28-30, 33-6.
9. McGurk M, MacBean A, Fan KF, Sproat C. Conservative management of salivary stones and benign parotid tumours: a description of the surgical techniques involved. *Ann R Australas Coll Dent Surg* 2004;**17**:41-4.
10. Zenk J, Gottwald F, Bozzato A, Iro H. [Submandibular sialoliths. Stone removal with organ preservation]. *HNO* 2005;**53(3)**:243-9.
11. Katz P. [New techniques for the treatment of salivary lithiasis: sialoendoscopy and extracorporal lithotripsy: 1773 cases]. *Ann Otolaryngol Chir Cervicofac* 2004;**121(3)**:123-32.