Salivary gland stones: diagnosis and treatment

Peter D Bull

Salivary calculi are a common cause of salivary gland disorder and may occur in any of the salivary glands and at almost any age. The stones may be small and intraductal or lie within the gland substance when they may become very large. They cause symptoms by obstructing salivary flow. Diagnosis is usually straightforward, and treatment is aimed at stone removal.

While the aetiology of salivary stones is poorly understood, they are much more common in the submandibular than in the parotid gland (83% as opposed to 10%), with the remainder being in the minor salivary glands or the sublingual glands (Rauch, 1959).

The reason for this is that the submandibular gland produces mucoid as well as serous saliva, allowing inspissation of the mucus to occur, particularly at times of dehydration or febrile illness. This then forms a nidus around which calcification can occur.

There appears to be no connection between the hardness of drinking water in an area and the incidence of salivary calculi in the population (Sherman and McGurk, 2000).

A Russian paper by Afanas'ev and Nikiforov (1999) suggested that a stricture in the duct might result in stasis and calculus formation. No metabolic cause of salivary stone formation has been demonstrated, although associations with diabetes and hypertension have been noted (Laforgia et al, 1989).

It has long been suspected that a small foreign body entering the salivary duct may act as a focus for stone formation, and Brophy (1916) demonstrated such detritus.

Saliva is saturated with hydroxyapatite, the basis of salivary stones. As a rule, acidic proteins in saliva will bind calcium and so prevent more frequent stone formation. Stones are ultimately formed by crystal formation from salivary solutes.

The structure of salivary calculi is that of progressive formation in layers around an organic nidus, usually with a laminar pattern. Riesco et al (1999) have shown an early sialolith from a minor salivary gland to have mineralized inclusion bodies, with calcium and phosphate being distributed in the outer coating of the stone.

Mature stones contain calcium phosphate in various crystalline forms associated with organic mucoprotein. Scanning electron microscopy has demonstrated concentric laminae (Taniguchi et al, 1979).

CLINICAL FEATURES OF SALIVARY CALCULI

While some calculi may remain symptomless and are found incidentally, the majority declare themselves by obstruction of salivary outflow. This leads to painful enlargement of the affected gland, and if prolonged stasis ensues, there will be subsequent infection.

The obstructed gland becomes tense and painful, usually during or immediately following a meal. Often the swelling subsides after an hour or so. If there is no associated infection, there is no redness of the gland, but there will be marked tenderness.

Inspection of the relevant salivary duct may reveal the presence of an impacted stone. The salivary flow will usually be reduced or absent, but there is usually no inflammation of the duct opening unless the condition is chronic.

On bimanual examination of the submandibular duct, it may be possible to feel a stone, usually in the anterior third of the duct. Parotid stones are much smaller and softer and are more difficult to feel.

Large stones may occur within the substance of a gland, usually the submandibular and only rarely the parotid. Here they may give rise to no symptoms and be found only because of a visible or palpable swelling, or incidentally on radiology.

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NATURAL HISTORY

Small calculi may discharge spontaneously from the duct, followed by a gush of turbid saliva (*Figure 1*). More usually, the stone in the duct will give rise to repeated episodes of duct obstruction and swelling. Ultimately, the gland will become atrophic and fibrosed (*Figure 2*) unless an acute abscess supervenes.

The cost of treating symptomatic salivary stones has been calculated by Escudier and McGurk (1999). Based on an incidence of 27 per million population and possibly up to 59 per million population per year, a cost in the English health regions of up to £4 million each year is suggested.

INVESTIGATION

The aim of investigation is to determine whether a stone is present in the duct or gland. Biochemical investigation is unrewarding unless recurrent sialolithiasis suggests hypercalcaemia.

Lateral plain X-rays are poor at showing salivary gland calculi. Most parotid stones are radiolucent, although 80–90% of submandibular stones contain calcium and so are visible on X-ray examination.

It is preferable to take intra-oral views of both the submandibular and parotid ducts, which are more likely to show intraductal stones (*Figure 3*).

Figure 1. Turbid saliva oozing from the parotid duct.

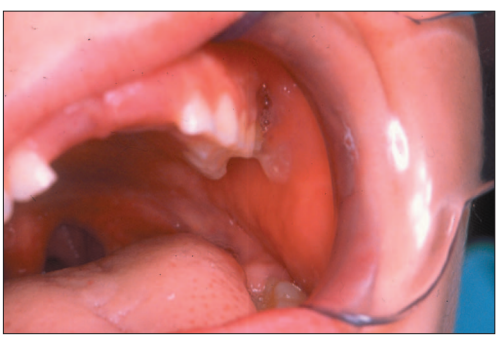
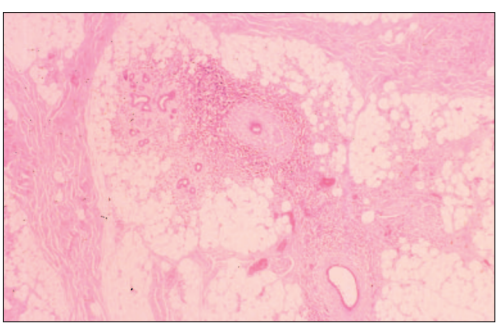


Figure 2. Histology of parotid gland showing chronic fibrosis and acinar atrophy.



If the stone is thought to be in the body of the submandibular gland, lateral or oblique films will show its presence (*Figure 4*). Only rarely do large calculi occur in the parotid, and they are unlikely to be radio-opaque. Magnetic resonance (MR) scanning will reveal stones and can be combined with digital subtraction sialography (Heverhagen et al, 2000).

Ultrasound scanning is of limited value but may show a parotid ductal stone. Dense calculi may be revealed by acoustic shadowing deep to the stone.

Computed tomography (CT) scanning, because of its sensitivity to calcium salts, is very accurate in finding calculi (Mandel and Hatzis, 2000) (*Figure 5*).

Sumi et al (1999) have described using MR and CT together as being complementary and found that when used in combination, they may be more accurate.

Endoscopy of the salivary ducts has been combined with endoscopic removal of salivary stones with a high rate of success and no major complications (Nahlieli and Baruchin, 1997).

Figure 3. Intra-oral view showing a large stone in the submandibular duct.

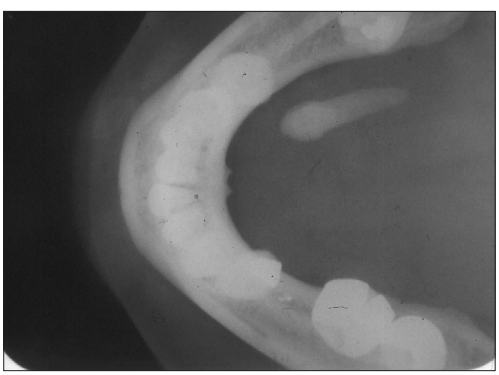
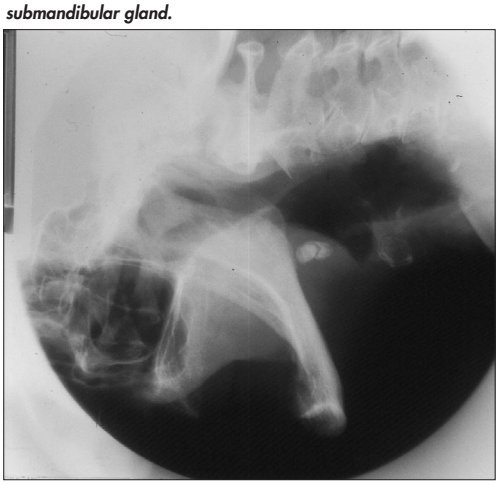


Figure 4. Lateral view showing a stone within the submandibular gland.



TREATMENT OF SIALOLITHIASIS

The treatment of salivary calculi is determined by the symptoms and by the position of the stone.

A symptomless stone found incidentally by clinical examination or radiology will usually require no treatment. A stone within the submandibular duct causing intermittent obstruction can usually be removed by the intra-oral route. If such a stone cannot be seen or felt, it will be difficult to remove. Similarly, a stone at the distal end of the parotid duct can be removed intra-orally.

A large stone within the submandibular gland or at the hilum will necessitate excision of the submandibular gland. Similarly, a stone deep within the ductal system of the parotid gland (*Figure 6*) will require parotidectomy. The surgery for these procedures has been described by Bull and Bath (1997). The overriding consideration is the avoidance of nerve damage. In parotid surgery, it is primarily the facial nerve which is at risk, while operations on the submandibular gland hazard the marginal mandibular branch of the facial nerve, the lingual nerve, which is intimately related to the submandibular duct, and the hypoglossal nerve if the gland is enlarged.

Removal of salivary calculi by a wire basket extractor under radiological control has been described (Drage et al, 2000). It is most effective in removing stones from the extraglandular duct of either the parotid or submandibular gland.

Extracorporeal shock wave lithotripsy has been described by Iro et al (1998) with encouraging results.

SURGICAL TECHNIQUE FOR REMOVING A STONE FROM THE SUBMANDIBULAR DUCT

The operation can be performed either under local or general anaesthetic. The mouth is opened widely and the calculus identified (*Figure 7*). Infiltration with local anaesthetic with added adrenaline (epinephrine) will reduce bleeding. A stay suture is passed around the duct proximal to the stone to prevent the stone slipping back. If the stone can be felt easily, a longitudinal incision over the calculus is made and the stone extracted (*Figure 8*). If the stone is more difficult to identify, the duct must be dissected and demonstrated, so that it can be opened. It can also be opened from its orifice, and the calculi milked forward. No attempt at closure of the duct is made. The position of the lingual nerve (sensory to the anterior two thirds of the tongue) must be considered and nerve damage avoided.

Figure 5. Computed tomography scan showing a stone within the left parotid gland.

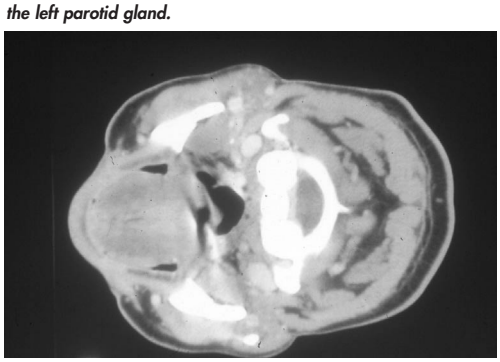


Figure 6. A calculus within the parotid duct (operative specimen).

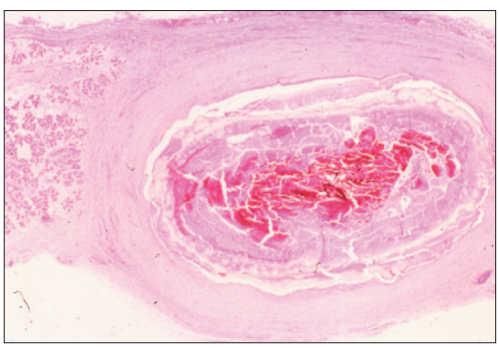
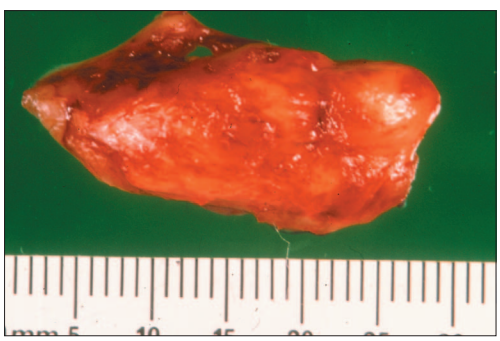


Figure 7. A stone at the orifice of the left submandibular duct.

Figure 8. The stone removed from the submandibular duct in Figure 3.



Complications include residual stones, ranula (retention cyst) in the floor of the mouth (*Figure 9*) and impairment of lingual nerve function.

CONCLUSION

While salivary stones are not life-threatening, their correct recognition and management are important in the avoidance of long-term morbidity and operative complications. New techniques, such as lithotripsy and endoscopy, hold promise of safe means of treatment in the future. HM

Conflict of interest: none.

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Figure 9. A submandibular ranula following duct surgery.

KEY POINTS

- Salivary gland stones are common and can occur at any age.
- Most stones form in the submandibular gland because of the mucoid nature of the saliva.
- Diagnosis is usually clinical, backed up by radiology if necessary.
- Treatment is usually by surgery, but newer techniques are being developed.