Diagnosis and Management of Submandibular Sialolithiasis

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ABSTRACT

BACKGROUND

Submandibular gland is the most common site of stone formation among all the salivary glands, owing to its long duct, mucus rich saliva and antigravity flow. Swelling and pain on eating is its most common presentation. Most salivary stones are made up of calcium phosphates, and only a few contain pure organic material. Surgical removal is required, and the route of surgery is planned according to the site and size of the stone.

METHODS

We conducted a cross sectional study on 25 consecutive patients with a clinical diagnosis of submandibular sialolithiasis. Thorough history taking and clinical examination was followed by ultrasound scan to confirm the diagnosis and establish the site and size of the stone. Stone procured after removal was analysed chemically in the biochemistry laboratory.

RESULTS

Out of 25 patients, calculi in 11 cases were found in the intraglandular part of the submandibular gland and in 14 cases in the intraductal part of the gland. Out of the 14 cases with stone in the intraductal part, in 4 cases the stone was removed with the help of sialagogues and milking due to the very small size of the stone; whereas, in 10 cases the stone was removed intraorally with marsupialisation of the duct under local anaesthesia. In 11 cases the gland had to be removed along with the stone. As per the biochemical analysis, calcium and phosphate stones were the commonest in our study followed by oxalate calculi. Obtained results showed that the studied salivary stones had almost 10% association with nephrolithiasis. The salivary pH was acidic in 10 cases and alkaline in 15 cases.

CONCLUSIONS

Characteristic history, thorough clinical examination and ultrasonic examination help us in the diagnosis of sialolithiasis. The site and size of the calculus is the deciding factor for the surgical plan. Biochemically stones are invariably composed of calcium and phosphates. Simultaneous occurrence of sialoliths and renal calculi was purely by chance or as a comorbidity needs to be studied more in a larger study group.

KEY WORDS

Sialolithiasis, Submandibular Gland, Calcium

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BACKGROUND

Sialolithiasis (salivary gland stones) is one of the most common diseases of the salivary glands with a prevalence of 1.2%. Males are affected twice as often as females.[1] The most common site of stone formation is the submandibular gland followed by parotid gland.[2] Submandibular calculi are more frequent as the pH of its saliva is more alkaline, and has more concentration of minerals like calcium and phosphate. Its saliva has a much more mucous content than saliva of other salivary glands. Also, the submandibular duct is much longer and the gland has a flow against gravity when compared with parotid gland.

Hallmark feature of sialolithiasis is episodic pain and swelling during meals which may last for a few hours, with interim symptom free periods. The commonest symptom in submandibular sialadenitis is swelling and next to follow is pain. Swelling and pain are more prominent when a stone is stuck in the duct than when the stone is in the gland itself.[3] Salivary stones can range in size from tiny particles to several centimeters in length; the largest reported stone in the submandibular duct was 72 mm in length.[4] Simultaneous sialolithiasis of more than one gland at the same time is rare.[5]

In the studies of sialoliths it has been observed that the mineral composition of sialoliths found in Wharton's duct differ from those found in other intraglandular ducts; this may imply that the ionic environment may differ in different ducts.[6] Both organic and inorganic salts make up a sialolith. The organic part varies from 23 to 100% and is mainly concentrated in the nucleus and the outer shell of the stone. Only a few sialoliths are made up of organic material alone; most salivary stones are made up of inorganic minerals like calcium phosphates, either as hydroxyapatite or carbonate apatite.

Submandibular stones contain less organic materials as compared to parotid gland stones. Various imaging techniques are available for the diagnostic investigation. One method of choice is B-mode ultrasound scanning. This noninvasive procedure allows stones of 1.5 mm or more in diameter to be detected with a sensitivity of 95% to 99.5%. If sialolithiasis is suspect clinically, ultrasonography with a linear scanner must be considered the investigation of choice. Sialography, computed tomography (CT), and magnetic resonance imaging (MRI) are more time-consuming, require radiation exposure, require contrast medium administration, and have higher costs and are therefore used for more complicated cases such as associated abscess. Diagnostic salivary gland endoscopy (SGE), on the other hand, has increased in importance in recent years and fills the diagnostic gap by allowing the direct visualization of stones.[7,8]

For very small stones or concretions within the duct management protocol consists of gland massage and milking. Antibiotics are to be given whenever infection is suspected. Almost all intraductal submandibular stones can be removed by an intraoral approach under local anaesthesia. The simple method of intraoral removal is treatment of choice in patients where stones that can be palpated bimanually. After stone removal, it is recommended that salivary gland massage is carried out several times a day, combined with a sour diet and sialagogues to stimulate the salivary flow.

Invasive management of sialolithiasis for recurrent attacks of sialadenitis because of the presence of stone in the gland itself is surgical removal of the gland. Though surgery has been the norm for years, nonsurgical methods are becoming more common. Endoscopy is a very helpful tool to fill the diagnostic gap in detecting Sialoliths[9.] Sialendoscopy using a micro endoscope can be used on an outpatient basis and without general anaesthesia or sedation. Sialendoscopy using a micro endoscope can be used on an outpatient basis and without general anaesthesia or sedation of. Extracorporeal salivary lithotripsy, based on the extracorporeal shock-wave lithotripsy (ESWL) method of treating renal calculi, carries fewer risks than the surgical approach.[10] A basket extractor under fluoroscopic guidance may be used to extract stone fragments that fail to pass after lithotripsy.[11] If a stone is detected, a laser fiber is advanced until the tip just touches the stone. With laser-induced shock waves (LASER lithotripsy), the stone is fragmented. The disintegrated stone particles can be flushed out by the clinician, or may flush out with the restored salivary flow.[12]

We wanted to determine the incidence of calculus in various sites in relation to submandibular gland and determine the biochemical composition of the calculus.

METHODS

It was a cross sectional study carried out in ENT and Biochemistry department of MMIMSR. A total of 25 consecutive patients on basis of convenient sampling with clinical and ultrasonic evidence of submandibular duct or gland calculus were taken for study. Informed written consent was taken from all the patients. Patients with a clinically evidence of submandibular duct or gland calculus after confirmation by ultrasonography. According to Performa, detailed history was taken; thorough general and local examination was carried out in all the patients to arrive at a provisional diagnosis. Clinical examination was followed by ultrasound scan to confirm the diagnosis. Associated history for co-morbidity like renal calculi was taken and where required ultrasound abdomen was also done. Patients were managed either by giving a course of antibiotics, adequate hydration, warm compresses and sialagogues or by surgery depending upon the clinical examination and ultrasound findings. Stones removed during surgery were sent for biochemical analysis, where each calculus was washed with distilled water and dried completely in incubator. The stones were crushed into fine powder and the analysis was done for oxalates, calcium, phosphate, carbonates and uric acid by protocols described by Hodgkinson. Analysis of salivary pH was done in the Department of Biochemistry. The patients were kept nil orally for 2 hours. Patients were asked to collect the saliva in mouth & swallow it. This was repeated twice, then the third time, some saliva was put onto the litmus paper. The colour of the litmus paper was noted, and pH was recorded.

Statistical analysis was performed using the IBM SPSS statistical Software Version. 22.0

RESULTS

In our study of 25 patients 14 were males and 11 were females. Majority of the patients were middle aged in the age group of

31-40 years followed by 41-50 years. The calculi in 11 cases were found in the intraglandular part of the submandibular gland and in 14 cases in the calculus was in the intraductal part. Regarding the biochemical analysis, calcium and phosphate stones were the commonest in our study followed by oxalate calculi [Table 1]. Obtained results showed that the studied salivary stones had an almost 10% association with nephrolithiasis. In our case the salivary pH was acidic in 10 cases and in 15 cases the pH was alkaline. In 4 cases the stone was removed with the help of sialagogues and milking. In 11 cases the gland had to be removed and in 10 cases the stone was removed intraorally with marsupialisation of the duct under local anaesthesia [Table 2]

Predominant Chemical Composition	No. of Cases	Percentage (%)
Calcium	25	100
Oxalate	21	84
Phosphate	25	100
Carbonate	01	2
Uric acid	01	2

Table 1. Predominant Calculus Composition with Number of Cases

Surgical Manipulation	Non-Invasive Treatment
Submandibular Gland Excision= 11	Milking of DUCT=4
Intraoral Removal of Stone with Marsupialization of DUCT= 10	

Table 2. Management of Patients with Sialolithiasis

DISCUSSION

Kopec and colleagues (2011)[13] stated that nearly 5 % of patients come to the ENT specialist with salivary gland pathology symptoms. Chronic sialadenitis is one of the commonest disorder that presents as recurrent episodes of infection and results in salivary hypo function. Diagnosis and management result in good recovery. Sialolithiasis can be diagnosed by careful consideration of history taking of patient illustrating typical symptoms and thorough clinical examination. Ultrasonography confirmed all our cases and as suggested by other authors is the investigation of choice.[14,15] In our study there was a male to female predilection. Sialoliths predominantly affected middle age individuals in the age group of 30 to 40 and 40 to 50 years.

Zenk J[15] in his study Clinical and diagnostic findings of sialolithiasis concluded that Sialoliths occurred most frequently in patients aged 30 and 70 years, with no male or female predilection. Taher AA[16]in his study of 95 patients with sialolithiasis observed male to female ratio of 2.5:1. In our study of all submandibular swellings Sialadenitis with duct calculus was more common than patients of sialadenitis with Intra-glandular calculus. S Kraaij et al[17] 2014 in his study concluded that the majority of the submandibular stones are located in Wharton's duct (90%), as contrast to parotid stones which are commonly located in the gland itself.

The main bulk of sialoliths is inorganic material. Submandibular stones are made up of 70–80% inorganic material. The mineral component increases proportional to the size of the sialolith, indicating that mineralization over the nucleus of organic matrix increases with time. Regarding the biochemical analysis, calcium and phosphate stones were the commonest in our study followed by oxalate calculi.

Taher AA[16] in his study of 95 patients with sialolithiasis did Chemical analysis of calculi taken from 88 patients, showed that 89.77 percent were with phosphate salts stones, 7.98 per cent were with oxalate salts, and 2.27 per cent were with urate salts which is comparable to our study. Hiraide F[18] concluded that minerals like calcium, phosphorous, potassium, sodium, magnesium, chlorine, sulphur, manganese; chromium and aluminium are equally distributed in the substance of the calculus. Also, obtained results show that the studied salivary stones had an almost 10% association with nephrolithiasis. Lustmann et al[2] found an incidence of renal stones of 10.7% in patients with sialolithiasis, which was higher than the incidence in the general population group. However Zenk J[15] in his study Clinical and diagnostic findings of sialolithiasis concluded that a simultaneous urinary tract stone or stone of the biliary tract occurred by mere chance (4.3%). Several studies suggested that patients with sialoliths suffer more frequently from renal calculi or gallbladder stones[2]. More studies with larger sample size are required to ascertain the association of renal calculi with sialoliths.

The salivary fluid, over 99% is made up of water. Saliva as a whole collected from the mouth apart from containing secretions of all the salivary glands also contains desquamated epithelial cells from oral cavity, normal flora of oral cavity, leucocytes, serum constituents and food particles. Major production of the saliva is from the Submandibular gland (60%) followed by Parotid gland (30%), about 5% by sublingual gland and 7% by minor salivary glands. The saliva that rests and forms a pool in the mouth determines the environment of the oral cavity. The normal pH range of saliva is 6.2-7.6 and 6.7 is the average pH. The resting pH of mouth does not fall below 6.3. In the oral cavity, the pH is maintained near neutrality (6.7-7.3) by saliva. The saliva helps to maintain a near neutral ph. The regular flow of saliva constantly keeps moving the food bolus that could be broken down by bacteria. Acidity from drinks, foods and bacterial activity, is neutralized by the buffering action of saliva.

In our case the predominant pH was acidic in 10 cases and alkaline in 15 cases. Lustmann[19] observed that there was continuous appositional growth of calcified layers around one central nidus. They also emphasized the role of microorganisms in the formation of calculi. The key to management of salivary stones is on removing the salivary stones and at the same time preserve the salivary gland function dependent on the size and location of the stone. Conservative management of small salivary stones in form of salivary gland massage, milking and the use of sialagogues helped in expulsion of small stones in 4 cases. In 10 cases intraoral removal of stone with marsupialisation of duct was done under local anesthesia as part of day care surgery. In 11 cases Submandibular gland excision was done.

CONCLUSIONS

Characteristic history, thorough clinical examination and ultrasonic examination help us in the diagnosis of sialolithiasis. The site and size of the calculus is the deciding factor for the surgical plan. Biochemically stones are invariably composed of calcium and phosphates. Simultaneous occurrence of sialoliths and renal calculi was purely by chance

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