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Original Research Article

Submandibular Gland Sialolithiasis: Epidemiology & Biochemical Analysis

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Abstract:

Background: Salivary stones are calcified structures most often found in the salivary gland duct. Submandibular gland and its duct is most commonly affected. Biochemical analysis of these stones may help in understanding the etiopathogenesis more effectively.

Materials and Methods: Submandibular gland sialoliths(n=28) were collected at the Dept of ENT & HNS, AIIMS, Udaipur between October 2023 and September 2024. Subsequently the biochemical composition of the stones was determined by FT-IR Spectrometry and data was statistically analysed.

Results: Biochemical analysis of the stones suggested that carbonate apatite was the chief element found in almost 85.7% followed by proteins.

Conclusions: Knowledge of biochemical composition of salivary sialoliths is essential for understanding their etiopathogenesis.

Keywords: Submandibular Gland, Calculi, Spectroscopy.

Introduction

Salivary gland stones are hardened mineral deposits that form in in the main duct of the submandibular or parotid salivary gland, which can cause mechanical blockage associated with stasis of the saliva in the duct and gland. When saliva cannot flow into the mouth symptoms like recurrent swelling, pain, dry mouth and sometimes as a result, inflammation of the gland occur.

The etiopathogenesis of salivary stones is not completely understood. There are three main theories: agglomeration of sialomicroliths, calcification of a mucus plug and an altered biochemical composition of saliva [1]. Su and co-workers [2] found that the saliva of patients with salivary stones is supersaturated with calcium and unsatiated with citrate, phytate and magnesium. It is assumed that salivary stasis or a decreased salivary flow contributes to the precipitation of calcium.

The stone composition chiefly consists of an amorphous, mineralized core surrounded by concentric laminated layers of organic and inorganic material. A very small percentage of sialoliths, submandibular as well as parotid, only consist of a core. Knowledge of the biochemical composition of salivary stones is essential for understanding their etiology. Hence our study aims to study the biochemical analysis of submandibular gland duct stones and aid us in drawing some significant findings.

Materials & Methods

This is an analytical study conducted from October 2023 to September 2024 the Department of ENT & HNS of the American International Institute of Medical Sciences, Udaipur. We obtained 28 submandibular gland stones from our patients. All stones were removed from the glandular duct by surgical excision and after removal, the stones were washed with distilled water and stored in plastic jars.

All the stones were analyzed by Fourier Transform Infrared spectrometry (FTIR) (mid infrared region 4000-400 cm-1) using the KBr disk technique. The size of a peak in the spectrum corresponds exactly with the quantity of a specific compound. Qualitative estimations of the presence of carbonate apatite, struvite, brushite, cystine, ammonium urate and proteins were obtained.

Submandibular gland duct stones from patients of all age groups were included in the study. Stones from any other salivary gland like parotid gland were excluded from the study. The findings were tabulated and analysed using appropriate statistical analysis.

Results

In our study, total number of stones analysed were 28 (n=28). There were 20 males and 8 females. 12 Submandibular gland stones were obtained from left side while 16 were obtained from right side (table 2). 20 stones were less than 5 mm while 8 stones obtained were more than 5mm (table 3)Biochemical analysis of the stones suggested that carbonate apatite was the chief element found followed by proteins. (Table 4).

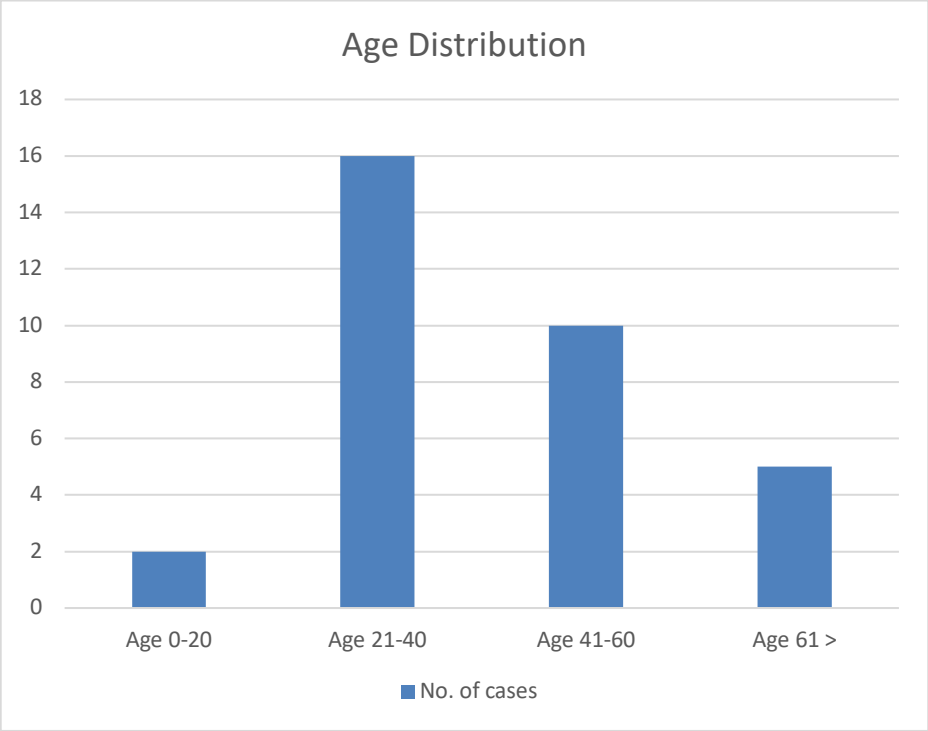

Figure 1: Age distribution of patients included

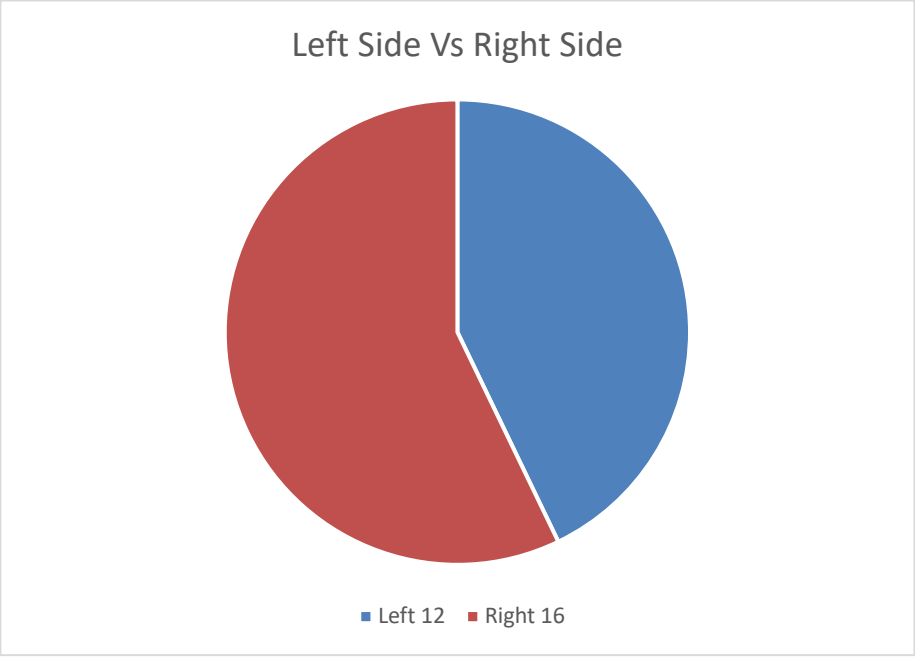

Figure 2: Stones obtained from left Vs Right side submandibular gland and duct

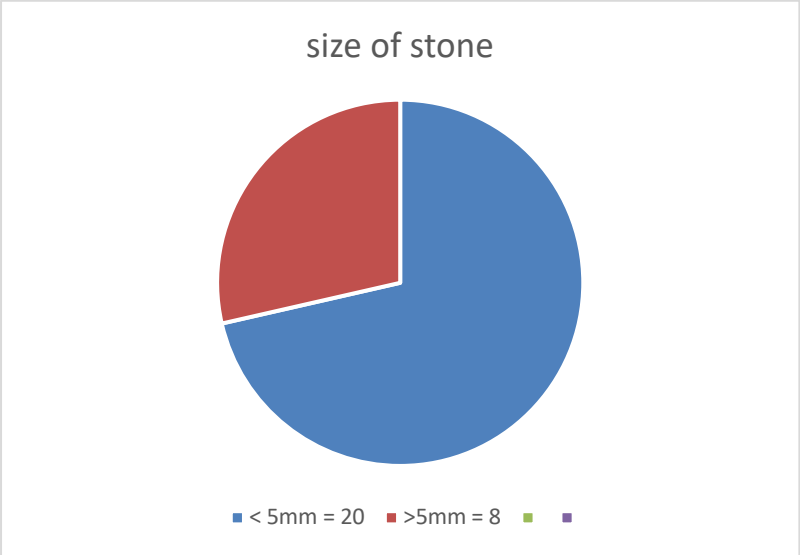

Figure 3: Size of stones obtained

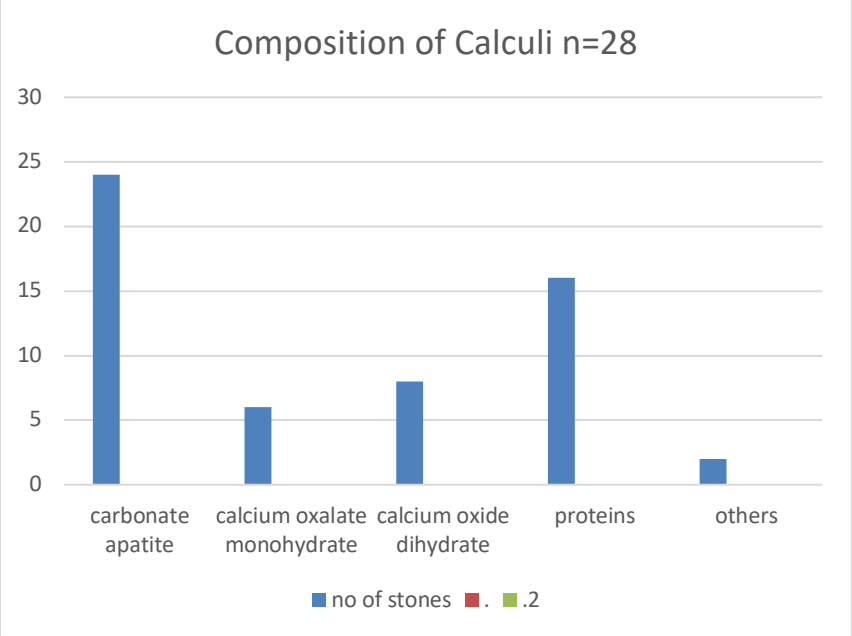

Figure 4: Biochemical analysis of calculi

Discussion

Incidence of Sialolithiasis in Submandibular gland is 80%, Parotid gland is 19% and Sublingual gland is 1%.[3] The higher occurrence in the submandibular gland relative to the parotid gland may be attributed to the anatomy and location of the duct and the alkaline content of saliva that has high mucin and calcium content.[3]

Sialolithiasis is usually seen between the age group of 30 and 60 year. It is uncommon in children as only 3% of all sialolithiasis cases has been reported in the pediatric populations. Our study showed maximum patients from age group of 21-40 years which is consistent with the study of Sreejith VP et al. [2] Saskia Kraaij et al mentioned that sialolithiasis is equally distributed between men and women. [1] Males: Female's ratio in our study is 5:2, which is almost similar to the study. Sreejith et al who showed that males are affected two times as much as females. [2]

In the present study 50. % stones consisted of oxalate. Kidney stones are mainly consisting of calcium oxalate, and they occur two to three times more often in men than in women. Watson and coworkers [4] showed that men with kidney stones have an increased serum testosterone levels suggesting its relation to the deposition of oxalate.

Sreejith et al suggested that the approximate size of stones ranges from 2.1 to 10mm. Most calculi are smaller than 10mm in size; giant ones of size larger

than 15mm occurring rarely. [2] In our study also majority of the stones i.e 20 stones excised were less than 5mm size and 8 stones were more than 5mm size. The size of the stone determines the appropriate treatment approach. Buyanbileg sodnom-Ish et al [3] suggested that stones larger than 3mm and located proximally may be retrieved endoscopically or surgically. Also, according to Gerni et al [5] a stone larger than 8mm has a higher chance of sialolithiasis recurrence and hence must be specifically taken care of intraoperatively; if preop radiology suggests a larger sized stone.

Knowledge of the biochemical composition of salivary stones is essential for understanding their etiology. Therefore, the aim of the present study was to investigate the major elements in the submandibular gland duct stone. 85.7% of the stones in our study were composed of carbonate apatite and 57% of the stones were composed of proteins followed by calcium oxalate dihydrate and calcium oxalate monohydrate respectively. The other elements like calcium phosphate, ammonium and others are extremely rare. Buyanbileg Sodnom-Ish et al also suggested that main elements of sialoliths are calcium, phosphate and oxalatethe main inorganic component of sialoliths was reported to be calcium apatite. [6] Insight in the biochemical composition of salivary stones might provide information to clarify the etiopathogenesis of salivary stones, to facilitate diagnosis, to prevent formation and to improve treatment.

Carbonate apatite is a mineral found in the teeth and bones of humans. Dental erosion caused by consuming acidic foods or drinks, using acidic hygiene products, or taking certain acidic medicines leads to loss of the carbonate apatite and its gradual accumulation in the salivary duct and gland. This may be correlated to its higher composition in submandibular gland stone; although a bigger sample size may provide a better information regarding its role in sialolithiasis.

Conclusions

The submandibular gland sialolithiasis is the commonest salivary gland stone found in ENT OPD. It is predominantly seen in young males and commonly found on left side. The study investigated and confirmed that carbonate apatite is the most common component of the Wharton duct calculi followed by proteins. Poor oral and dental hygiene may also play a role in salivary gland sialolithiasis.

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