CT Scan as an Essential Tool in Diagnosis of Non-radiopaque Sialoliths

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Abstract Sialolithiasis is the second most common disease of the salivary glands and the main cause of salivary gland obstruction. Diagnosis of calculi/sialoliths can be made by means of an elaborate history, precise clinical examination and radiographic support. But all sialoliths do not present with predictable signs and symptoms and radiographic appearance. Sialoliths have a variety of manifestations and they may or may not be radiopaque. Non-radiopaque sialoliths are difficult to diagnose radiographically. Although newer techniques like CBCT, CT virtual sialandoscopy and established techniques like sialography, xeroradiography can be useful in selected cases. A regular CT scan is an excellent tool in the diagnosis of a non-radiopaque sialolith and associated salivary gland changes. CT scan should be considered as an important tool of imaging for diagnosis, treatment planning and follow-up of all cases of sialoliths and associated pathologies of the salivary gland.

Keywords Sialolith · Submandibular gland · CT scan · Salivary gland disorder

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Introduction

Lithiasis is the occurrence of a calcified mass within the ducts or parenchyma of glandular structures. Sialolithiasis is a pathological condition characterized by the presence of one or more calcified stones (sialoliths) within the salivary gland itself or within the duct. Sialolithiasis accounts for more than 50 % of diseases of the major salivary glands and thus is the most common cause of acute and chronic infections [1]. More than 80 % of all the sialoliths occur in the submandibular gland or its duct, 6 % in the parotid gland and 2 % in the sublingual gland or minor salivary gland [2]. Sialoliths are formed by the deposition of mineral substances in layers around a nidus composed of desquamated cells, necrotic debris or foreign bodies. Clinically sialolith shape can be round, oval or elongated with irregular, knobby or granular surface area [3]. They consist of mainly calcium phosphate with small amounts of carbonates in the form of hydroxyapatite, and with smaller amounts of magnesium, potassium and ammonia. This mix is distributed evenly throughout [4].

Sialoliths of the submandibular gland or its duct are a common cause of acute and chronic infections. This case report describes a patient presenting with an unusually enlarged submandibular gland because of a large submandibular duct sialolith and its diagnosis with special emphasis on the use of computed tomography scan for the non-radiopaque sialoliths.

Case Report

A 45 year old male reported to the oral and maxillofacial surgery centre with a chief complaint of pain and swelling on the left side of the neck (Fig. 1). The patient recalled that

he had discomfort in this region while eating his meals since about 2 years. He noticed a swelling in the neck on the left side about 6 months ago. The swelling was present a little below his ear and it increased in size while eating meals. This was accompanied with excruciating pain which subsided as the swelling decreased. The patient reported to a physician who prescribed antibiotics for 5 days but to no avail. About 3 days before reporting to our centre, the swelling and pain increased with no relief with analgesics.

The patient was a smoker and smoked about 40 cigarettes a day since 10 years. His medical history was otherwise unremarkable. Extra oral examination revealed a $7 \times 3 \times 5$ cm swelling in the left submandibular region. The swelling was firm and tender. The skin over the swelling was normal and non-adherent. Intraoral examination showed root stumps in the region of 35 and 36. The buccal mucosa, floor of the mouth, tongue and palatal mucosa appeared normal. No conclusion could be drawn on intraoral palpation. No discharge was elicited on milking the swelling but the manipulation of gland led to increase in pain. Panoramic radiograph and occlusal view of the mandible showed no abnormalities (Fig. 1).

With a clinical diagnosis of left submandibular gland sialadenitis, a CT scan was performed. The CT scan showed presence of a sialolith in the left submandibular duct (Figs. 2, 3). The sialolith was oblong to elliptical in shape but in CT scan only a small part of the sialolith could be seen in each slice and thus it could not define the exact shape and size of the hypocalcified mass. Hence the CT scan helped us reach a diagnosis consistent with a sialolith which otherwise was not visible on conventional radiographs. On reviewing the occlusal radiograph, a hypocalcified mass, rod like in appearance was seen on careful examination (Fig. 4). This highlights the fact that sometimes conventional radiographs cannot be interpreted correctly in such cases of non-radio opaque sialoliths.

Fig. 1 Pre-operative OPG

Fig. 2 Pre-operative CT scan showing sialolith

Fig. 3 Pre-operative CT scan showing submandibular gland enlargement

Fig. 4 Pre-operative occlusal view radiograph

Under LA the lingual nerve block on the left side and local infiltration, tongue was raised and a bulge of the sialolith could be slightly seen on the floor of the mouth. A suture was placed behind the intraoral swelling in the floor of the mouth to prevent slipping of the sialolith. An incision was made over the bulge and by blunt dissection the sialolith was exposed transorally and removed (Fig. 5). The wharton's duct is not routinely repaired or stented [5].

A purulent fluid was found to exude immediately and was collected for culture and sensitivity assay. The gland was milked to drain out any residual exudate till clear saliva started to flow out of the duct. Copious irrigation was done and wound was sutured. Besides the routine instructions, the patient was asked to consume an extra liter of fluid to keep him hydrated and lozenges were prescribed to stimulate the flow of saliva. Within 15 days the enlarged gland had considerably subsided on the CT scan, the flow of saliva restored and the patient was relieved of his symptoms (Fig. 6). Concomitant presence of submandibular gland pathology needed to be ruled out, hence patient was advised another CT scan. Post operative CT scan showed absence of any residual nidus in the duct and regression of the left submandibular swelling was evident on follow-up visit (Fig. 7).

Discussion

Diagnosis of calculi/sialoliths can be made by means of a perfect and elaborate history, precise clinical examination and a radiographic support. Usually sialolithiasis is characterized by intermittent pain and swelling of the affected gland, mainly at meal times. The duration of symptoms may vary from days in the most acute cases to years in the most chronic cases before patients seek evaluation. As in this case, the patient was aware of the discomfort for more than a year, but did not seek medical help. Clinical symptoms vary according to the size of

Fig. 5 The extracted sialolith

Fig. 6 Post-operative CT scan showing absence of sialolith nidus

Fig. 7 Post-operative CT scan showing regression of submandibular swelling

the calculi, presence of infection and the degree of occlusion produced. In our case also there was a complete blockage of the flow of saliva and this stagnation of fluid under pressure produced pain and swelling. Frequently in chronically inflamed gland, a subsequent infection ensues leading to swelling, pain and fever. This is indistinguishable from recurrent non-obstructive sialadenitis [6]. Similarly, in this case the symptoms mimicked recurrent sialadenitis, the sialolith was missed clinically and antibiotics were prescribed as the line of treatment. The conventional diagnostic methods for detecting obstructions in the salivary ductal system are occlusal films, panoramic radiographs and sialography.

All sialoliths are not radiopaque. In one study it was found that 71 % of sialoliths of the parotid gland were radiographically identifiable through conventional means [7]. In this case, the conventional radiographs like OPG and occlusal films did not reveal much but the CT scan helped in reaching a diagnosis of a sialolith in the submandibular gland duct with the diffuse enlargement of the

left submandibular gland. Contrast sialography was not done as it would have required an invasive procedure. This is in accordance with the algorithm for major salivary gland imaging proposed by Yousem et al. [8]. According to them, the algorithm for imaging the salivary glands depends on the clinical scenario with which the patient presents to the clinician. Sialography is contraindicated in acute setting of sialadenitis because of the possibility of exacerbating the symptoms associated with the infection [9, 10]. Because of the importance of identifying small calculi in the gland or salivary duct as the cause of the symptom complex, non-enhanced computed tomography is often the best initial study for the evaluation of the painful gland. In computed tomography, multiplanar views can be obtained and reconstructed in spatial arrangements without superimposition of structures. Sialoliths are also adequately viewed on CBCT (cone beam computed tomography) [11]. If an infiltrative neoplasm is highly suspected, non-enhanced and enhanced magnetic resonance (MR) imaging may be superior in demonstrating perineural, meningeal, and skull base invasion. Sialography is reserved for the evaluation of chronic sialadenitis unrelated to sialolithiasis. The ratio of the crystalline carbonate apatite to the organic component of the sialolith determines the radio density band. Thus, a few sialoliths are identifiable by conventional radiography and some are non-radio opaque. Xeroradiography can aid in the diagnosis of non-radio opaque sialoliths as suggested by Richard et al. [12]. CT virtual sialendoscopy provides another potential imaging tool for direct visualization of endoluminal view of salivary ducts. However, in vivo studies are needed for reaching some final conclusion [13]. CT scans are useful in identifying parenchymal or extraparenchymal masses that can cause obstruction by pressure or ductal invasion [10]. However, in this case of a non radio opaque sialolith a routine CT scan was the tool that indicated the presence of a sialolith in the duct of submandibular gland.

The location of the sialolithiasis or the obstruction is the key of successful treatment. CT scan is invaluable in the diagnosis of a non-radio opaque sialolith as illustrated by the case presented herein. Because sialolithiasis may have a variety of manifestations, CT should be the mainstay of imaging. Optimal imaging evaluation of the salivary glands may require nonenhanced (to visualize sialoliths), enhanced (to identify abscesses, cysts, and neoplasms), or both nonenhanced and enhanced (for painful masses for which one cannot exclude sialolithiasis) CT scans [8].

A non-enhanced CT scan is the most commonly available diagnostic tool now available almost everywhere in the developing country like India irrespective of rural or urban areas. Hence, this accessibility gives an edge to CT scans over other diagnostic methods for salivary gland imaging.

The treatment of salivary gland obstructive pathosis is divided into two categories depending on the basis of location:

1. Obstructions which can be reached by an intraoral route i.e. up to the curvature above the lingual nerve in the Wharton's duct and anterior to the curvature around the masseter muscle in the Stenson's duct.
2. The obstructions which cannot be reached intraorally and can be removed during sialadenectomy or through an external approach.

The calculi found in the anterior part of the Wharton's duct can easily be reached using conventional methods. Removal of obstruction from the ductal system usually cures the ailment, even if long standing calculi are present [14]. According to literature, patients with submandibular gland disorders have an excellent prognosis [15]. Submandibular gland removal may be indicated following failure of lithotripsy or if the size of an intraglandular stone reaches 12 mm or more as the success of lithotripsy may be less than 20 % in such cases [9].

Partial obstruction of the duct of a major salivary gland produces pronounced symptoms but severe symptoms arise on complete occlusion of the duct. The retained saliva applies retrograde pressure on the salivary gland, the chyma and the ductal system. Its accepted treatment is to postpone sialolithectomy in the acute stage, particularly in those cases in which removal of the sialolith is surgically difficult. In such cases, antibiotic medication is essential until the swelling and pain subsides and surgery becomes possible. However, it is preferable to perform immediate sialolithectomy even in the acute stage because this facilitates immediate relief of glandular pressure by draining the exudate and releasing the retained saliva [16]. Similarly, in our case, remission of the symptoms was observed on post-operative visit and regression in the size of the gland was seen on post-operative CT scan two weeks after surgery.

Despite the surgical intervention technique followed, CT scan is an excellent tool in the follow up period as it is a useful guide to see any residual nidus of the sialolith as well as to study gland recession or changes. Hence the role of CT scan as a preoperative diagnostic tool as well as post operative guide in diagnosis, treatment planning and follow up of sialoliths cannot be overemphasized. The CT scan in spite of being an expensive technique with high radiation exposure yet in cases of non-radio opaque sialoliths and associated salivary gland changes/pathologies is a better option than conventional radiography which does not show concomitant salivary gland changes.

Conflict of interest None.

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