Sialolithiasis

1.0 Contact Hour

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Sialolithiasis

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Objectives:

At the completion of this course, the learner will be able to:

1. Explain in which salivary gland calculi are most commonly found.
2. Explain the chemical composition of the various types of salivary calculi.
3. Explain the anatomy and physiology of the salivary system.
4. Explain the various theories about what causes salivary calculi.
5. List and explain the various treatments used to manage the patient with salivary calculi.

Introduction

Sialolithiasis is the most common disease of the salivary glands, affecting 12 in 1000 of the adult population[1], with males affected twice as often as females.[2] Males between 30 and 60 years of age have the highest incidence of salivary stones.[3,4,5]

These formations of calculi are commonly found in the submandibular salivary gland, the parotid gland and their ductal systems, with 80% of calculi found in the submandibular system.[6,7,8] These stones can be single or multiple, and may vary in size. Stones are more palpable intraorally in the anterior region, and become less so as one travels posteriorly.[9] Cadaver studies suggest that 1 in 100 adults have salivary stones, but the majority are asymptomatic.[10] Salivary stones can range in size from tiny particles to several centimeters in length; the largest reported stone in the submandibular duct was 3.6 cm in length.[11] Simultaneous sialolithiasis of more than one gland at the same time is rare.[12] Studies of sialoliths reveals different structures and mineralization patterns that suggests different formation of their formation. 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.[13]

Forty percent of parotid and 20% of submandibular stones are not radiopaque and sialography may be required to locate them.[2] Calculi consist mainly of calcium phosphate and smaller amounts of carbonates in the form of hydoxyapatite, with smaller amounts of magnesium, potassium and ammonia.[14] Submandibular stones are 82% inorganic and 18% organic material, whereas parotid stones are composed of 49% inorganic and 51% organic material,[15] with the organic material composed of various carbohydrates and amino acids.[14]

The exact etiology and pathogenesis of salivary calculi is largely unknown. It has been speculated that, in the process of calculi formation, degenerative substances are emitted by saliva and calcification then occurs around these substances, and finally calculi are formed.[16] They are thought to occur because of deposition of calcium salts around an initial organic nidus consisting of altered salivary mucins, bacteria and desquamated epithelial cells.[2,17] For stone formation it is likely that intermittent stasis produces a change in the mucoid element of saliva, which forms a gel. This gel produces a framework for deposition of salts and organic substances producing a stone.[14] This may occur in two phases: first with formation of a central core, and then a layered periphery.[18] The central core is formed by the precipitation of salts, which is followed by deposition of organic and nonorganic material.[19] Submandibular sialolithiasis is more common because its saliva is more alkaline, has an increased concentration of calcium and phosphate, and has a higher mucous content than saliva of the parotid and sublingual glands.[1,20] Gout is the only systemic illness known to predispose a patient to salivary stone formation,[21] although in gout the stones are made predominantly of uric acid.[14] The fundamental association between sialolithiasis and an underlying systemic disorder or a common cause for generalized stone development in the urinary tract, bile duct system and the salivary ducts has often been discussed in the literature; however, this hypothesis could not be verified by a clinical study; [22] therefore, the exact mechanism of the formation of calculi is still unclear.

Anatomy and physiology of the salivary system

Salivary stones are found most commonly in the submandibular gland, with the parotid gland the next most common site.[23] The largest of the salivary glands is the parotid, with its associated Stensen's duct which is approximately 5-6 cm in length. Stensen's duct empties into the oral cavity in the area of the upper second molar.[24] The submandibular gland is located between the anterior and posterior belly of the digastric and hypoglossal muscle, with its duct about 5 – 6 cm in length.[24] The sublingual gland is located in the floor of the mouth above the mylohyoid muscle and directly under the floor of the oral mucosa. The duct of the sublingual gland general joins the duct of the submandibular gland.[22]

History and Physical Examination

The onset of pain may be gradual or sudden. Swelling of the affected gland may become pronounced with eating or during other visual or olfactory stimuli that create a salivary response, and then may slowly decrease when eating is completed. Complete obstruction may cause constant pain and swelling, while purulent drainage associated with a bad taste in the mouth may indicate systemic infection.[25] About 50% of patients present with painful swelling of the affected salivary gland (salivary gland colic), while 46% present with swelling not associated with pain. Patients may report a history of symptoms lasting anywhere form one day to several years.[22]

Bimanual palpation of the floor of the mouth, in a posterior-to-anterior direction, may reveal a palpable stone in a large number of cases of submandibular calculi formation. Bimanual palpation of the gland itself may be useful; a uniformly firm or hard gland suggests a hypofunctional or nonfunctional gland. For parotid stones, careful intraoral palpation around the Stenson's duct orifice may reveal a stone.[14]

Imaging Studies

Various imaging studies may be used to diagnose and evaluate salivary stones. Radiographs will allow 80% of submandibular calculi and 20% of parotid calculi to be detected.[26] Ultrasound will show a hyperechoic area where the calculus is present and an anechoic area behind the mass, while CT scanning will demonstrate the calculus by revealing a bright opaque area.[9] Sialography is useful in patients showing deep submandibular or parotid stones; however, it is contraindicated in acute infections or allergy to contrast material.[14] The superficial location of the submandibular gland makes it ideal for ultrasound evaluation and a useful adjunct to clinical examination. In the assessment of submandibular pathology, ultrasound allows glandular lesions to be localized and differentiated. These lesions can be further characterized as being benign or malignant and the extent of any extraglandular extension determined. Ultrasound is the first-line diagnostic method used in the assessment of sialolithiasis due to its high specificity and sensitivity. In severe infective sialadenitis, ultrasound can confirm the presence and guide drainage of abscesses. [27, 24]

Diagnosis

Sialolithiasis should be considered in every case of swelling of the salivary glands or sialadenitis. Stones trapped within the distal Wharton's duct can be detected by bimanual palpation of the submandibular gland and the floor of the mouth, while parotid stones are more difficult to palpate because of the anatomy of the ductal system.[22]

Treatment

In many cases the calculus or calculi will pass on their own; however, retained stones may cause significant discomfort and infection leading to atrophy of the gland. If gland tenderness and swelling develop, moist heat, gland massage, and an antibiotic should be prescribed. If this regimen fails, then other options need to be considered.

Though surgery has been the norm for years, nonsurgical methods are becoming more common. Extracorporeal salivary lithotripsy, based on the extracorporeal shock-wave lithotripsy (ESWL) method of treating renal calculi, carries fewer risks than the surgical approach.[28] A basket extractor under fluoroscopic guidance may be used to extract stone fragments that fail to pass after lithotripsy.[29] Sialendoscopy using a microendoscope can be used on an outpatient basis and without general anesthesia or sedation of the patient. If a stone is detected, a laser fiber is advanced until the tip just touches the stone. With laser-induced shock waves (laserlithotipsy), the stone is fragmented. The disintegrated stone particles can be flushed out by the clinician, or may flush out with the restored salivary flow.[30]

Conclusion

The primary care clinician is usually the first to see a patient with complaints of a salivary stone. If the stone is partially protruding from the duct, it can be grasped with a pair of hemostats and generally be easily removed. If the stone lies deep in the tissue, or otherwise cannot be easily removed by the clinician, the patient should be started on antibiotics and referred to an otolaryngologist.

References

1. Leung AK. Choi MC, Wagner GA. Multiple sialoliths and a sialolith of unusual size in the submandibular duct. *Oral Surg Oral Med Oral Path Oral Radiol Endo*. 1999;87:331-333.

2. Cawson RA, Odell EW. Essentials of oral pathology and oral medicine. 6th ed. pp 239-240. Edinburg, Churchill Livingstone 1998.

3. Grases F, Santiago C, Simonet BM, et al. Sialolithiasis: mechanism of calculi formation and etiologic factors. *Clin Chim Acta*. 2003;334:131-136.

4. Chu DW, Chow TL, Lim BH, et al. Endoscopic management of submandibular sialolithiasis. *Surg Endosc*. 2003;17:876-879.

5. Austin T, Davis, Chan T. Sialolithiasis of submandibular gland. *J Emerg Med*. 2004;26:221-223.

6. Gorlin RJ, Goldman HM. Thomas's Oral Pathology. 6th ed. pp 997-1001. St. Louis, C.V. Mosby Company 1970.

7. Levy DM, Remine WH, Devine KD. Salivary gland calculi. *JAMA* 1962;181:1115.

8. Naraynsingh V. Giant submandibular gland calculi. *J Oral Maxofacial Surg* 1985;43:384-385.

9. Nguyen QP, Mandel L. Sialolithiasis in the Submandibular Gland. Columbia Dental Review 1999;4:31-33.

10. Asfar S, Steityeh M, Abdul-Amir R. Giant salivary calculi: an orocervical fistula caused by a submandibular gland calculus. *Canadian J Surg* 1989;32(2):295-296.

11. Isacsson G, Person NE. The gigantic salivary calculus. *International J Oral* Surg. 1982;11(2):135-139.

12. Teymoortash A, Ramaswamy A, Werner JA. Is there evidence of a sphincter system in Wharton's duct? Etiological factors related to sialoliths formation. *J Oral Sci*. 2003;45(4):233-235.

13. Teymoortash A, Buck P, Jepsen H, et al. Sialolith crystals localized intraglandularly and in the Wharton's duct of the human submandibular: and X-ray diffraction analysis. *Arch Oral Biol*. 2003;48:233-236.

14. Williams MF. Sialolithiasis. *Otolaryngol Clin N Amer*. 1999;32:819-834.

15. Zenk J, Benzel W, Iro H. New modalities in the management of Sialolithiasis. *Minimally invasive therapy*. 1994;3;275-284.

16. Mimura M, Tanaka N, Ichinose S, et al. Possible etiology of calculi formation in salivary glands: biophysical analysis of calculus. *Med Molec Morphol*. 2005;38(3).

17. Carr SJ. Sialolith of unusual size and configuration. *Oral Surg Oral Med Oral Pathol* 1965;20:709-712.

18. Marchul F, Kurt AM, Dulguerov P, Lehmann W. Retrograde theory in sialolithiasis

formation. *Arch Otolaryngol – Head Neck Surg*. 2001;127:66-68.

19. Rauch S, Gorlin RJ. Disease of the salivary glands. In: Gorlin RJ, Goldmann HM, eds. Thomas' Oral Pathology. St. Louis: Mosby-Year Book, Inc;1970:997-1003.

20. Zakaria MA. Giant calculi of the submandibular salivary gland. *Br J Oral Surg*. 1981;19:230-232.

21. Work WP, Hecht DW. Inflammatory diseases of the major salivary glands. In: Papperalla MM, Shumrick DF eds: Otolaryngology, vol 3, 1980. Philadelphia, WB Saunders, 2235-2243.

22. Iro H, Dlugaiczyk J, Zenk J. Current concepts in the diagnosis and treatment of sialolithiasis. *Br J Hosp* Med. 2006;67(1):24-28

23. Lustmann J, Regev E, Melamed Y. Sialolithiasis. A survey on 245 patients and a review of the literature. *Int J Oral Maxillofac Surg*. 1990;19:135-138.

24. Zenk J, Kocj M, Bozzato A, et al. Sialoscopy – initial experiences with a new endoscope. *Br J Maxillofac Surg*. 2004;42:293-298.

25. Pollack CV, Severence HW. Sialolithiasis: case studies and review. *J Emerg Med*. 1990;8:561-565.

26. Cotter J. Spontaneous passage of giant salivary calculus. *Irish Med J*. 1998;91:28.

27. Alyas F, Lewis K, Williams M, et al., Diseases of the submandibular gland as demonstrated using high-resolution ultrasound. *Br J Radiol*. 2005;78:362-369.

28. Iro H, Schneider HT, Froda C. Shockwave lithotripsy of salivary duct stones. *Lancet*. 1992;339:1333-1336.

29 . Drage NA, et al. Interventional radiology in the removal of salivary calculi. *Radiology*. January 2000;214:139-142.

30. Gundlach P, Scherer H, Hopf J, et al. Die endoskopisch kontrollierte Laserlithotipsie von Speichelsteinen. In-vitroUntersuchungen und erster Klinischer Einsatz. *HNO*. 1990;38:247-250.