Case Report

Transoral Sonographic Diagnosis of Submandibular Duct Calculi

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ABSTRACT: We present a case of submandibular duct calculi diagnosed using transoral sonography. Sonography is the first-line imaging modality of salivary gland calculi. However, it is performed via a transcutaneous approach, which is limited in identifying small salivary duct calculi. Using an intraoral transducer, transoral sonography can visualize the submandibular duct and detect the presence of small calculi, thus overcoming the limitations of transcutaneous sonography.

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The submandibular gland is the most common site of calculi formation. About 85% of submandibular gland calculi are located in Wharton’s duct, whereas the remaining 15% lie in the gland parenchyma. Sonography (US) is preferred for the diagnosis of salivary gland calculi. However, tiny calculi, especially in the region of the salivary duct opening, are hard to visualize on conventional US examination of the neck. We describe how we diagnosed multiple small submandibular duct calculi using a transducer designed for transoral US (TOUS).

CASE REPORT

A 13-year-old boy was admitted to our institution because of right postprandial submandibular discomfort. It was the first episode of such symptoms and he had no past medical or surgical history. He did not complain of fever, headache, myalgia, or trismus. On admission, there was swelling in either submandibular region. The physical examination including the oral cavity was normal. Bimanual palpation failed to detect any palpable lesion in the sublingual area. Laboratory tests showed elevated C-reactive protein (0.96 mg/dl; normal: 0–0.3). The serum amylase (94 U/l; normal: 28–160), white blood cell count (5.31/mm³; normal 4.0–10.0; 48.9% neutrophils and 37.9% lymphocytes), negative mumps IgM (0.73), positive mumps IgG (2.26), and the electrolyte levels were within the normal ranges.

US was performed with an E-CUBE 9 scanner (Alpinion, Seoul, Korea) using two types of transducers, a 3–12-MHz linear transducer for conventional transcutaneous scanning, and a new 3–12-MHz intraoral transducer for TOUS scanning (Figure 1). Transcutaneous US showed a slightly hypoechoic parenchyma in the right submandibular gland, but did not show any other specific findings around the submandibular and sublingual glands with no cervical lymph nodes. TOUS revealed three stones within the proximal portion of the submandibular duct (Figure 2A-C).

The patient underwent surgery to remove the calculi via an intraoral approach (Figure 3). There were no complications in the postoperative period and the patient did not have any complaint on subsequent follow-up.

DISCUSSION

Sialolithiasis is the most common disorder of major salivary glands. The submandibular
gland is the most common site for calculi formation (about 80% among major salivary glands), because it produces particularly viscous, mucous, and more alkaline saliva with a relatively high concentration of hydroxyapatites and phosphates. Also, the opening of the main salivary duct of the submandibular gland is narrower than the diameter of the whole duct. In addition, the duct ascends toward its opening, which leads to saliva stagnation and retention. The most common site of submandibular duct for calculi formation is the proximal segment where the duct wraps around the posterior edge of the mylohyoid muscle at a steep angle and where 35% of the deposits are located. Thirty percent of the calculi are located near the opening of Wharton’s duct, and 20% in its mid portion.

Modalities used to diagnose salivary gland calculi include US, plain radiographs, sialography, CT, MR sialography, and sialoendoscopy. However, up to 20% of the calculi cannot be revealed with radiographs. Sialography’s disadvantages include patient’s exposure to ionizing radiation and iodine contrast media, pain during the contrast medium injection into the salivary ducts, the possibility of calculi dislocation toward the inside of the gland, and operator dependence in both salivary duct cannulation and result interpretation. CT detects calcifications with a high sensitivity; however, it provides a poor visualization of salivary ducts and lesions within them as well as patient’s exposition to ionizing radiation and the relatively high examination cost. The MR sialography allows a precise evaluation of salivary calculi; however, a negative result does not exclude the presence of small nonobstructing (2–3 mm) calculi. A major drawback of MR sialography remains its cost. Sialoendoscopy is minimally invasive and is not suitable for a first-line modality.

US with high-frequency linear transducers (10–13 MHz) is the first-choice test for the diagnosis of salivary gland calculi. A typical US image of a stone involves an echogenic, round, or oval structure that produces an acoustic shadow. However, stones smaller than 2 mm may not produce an acoustic shadow. US can visualize nonopaque calculi with a sensitivity of 80–96%. Although US works well with intraparenchymal calculi, its sensitivity decreases for ductal stones. Sensitivity of US in calculus detection has been reported with a 94% specificity of up to 100% and overall accuracy of 96%. False negative results may occur with very small stones in intraparenchymal ducts with no duct distension. Hyperechoic air bubbles mixed with the saliva may mimic stones. In addition, tiny stones in the region of the submandibular duct opening are hard to visualize with US even though 65% of cases are associated with salivary duct dilatation.

The intraoral transducer that we used is small and handy and has a high-frequency range (3–12 MHz) (Figure 1A, B). It was developed for intraoral use and to scan other musculoskeletal parts in the head and neck. With the transducer, TOUS can be performed conveniently and quickly at an outpatient clinic. TOUS makes it possible to visualize oral cavity organs, such as sublingual gland, submandibular duct, tongue, lips, tonsils and soft palate, which are virtually impossible to image with conventional US. TOUS has also been used to image and biopsy perioral and retropharyngeal lesions. For TOUS scanning, there were several studies using endovaginal, endocavitary, or hockey stick transducer. However, in the case of patients with trismus, sensitive gag reflex, or in children, it is difficult to use in an office-based setting with these transducers; however, our newly designed, smaller, and handier intraoral transducer can overcome this drawback. To the best
of our knowledge, the use of TOUS for imaging the submandibular duct has not been reported in the literature.

In general, it is difficult to visualize a nondilated submandibular duct on conventional US, except in very slim individuals. However, TOUS enabled the examination of the nondilated normal contralateral submandibular duct (Figure 2C).

In conclusion, a TOUS examination with an intraoral transducer may be useful for diagnosis in patients with symptoms suspicious for submandibular duct calculi, the detection of very small calculi.

REFERENCES

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