T2 Shine-Through Phenomenon in a Plunging Ranula

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ABSTRACT

Aim This case report aims to demonstrate a case of T2 shine-through using MRI and clinical features in a patient with a plunging ranula.
Case Report In this report, a 16-year-old male presented with a left submandibular space expansion and a painless intraoral cystic lesion near the caruncula sublingualis. Clinical signs pointed towards a plunging ranula. MRI revealed a hypointense, well-defined lesion in T1 images and a hyperintense lesion extending from the sublingual gland through musculus mylohyoideus to the submandibular space, featuring a characteristic tail sign in T2 images. Notably, diffusion-weighted (DWI) TRACE images and apparent diffusion coefficient (ADC) images both displayed a hyperintense lesion, indicative of T2 shine-through. The combined evaluation of fine-needle aspiration cytology and imaging led to the diagnosis of a plunging ranula, and the patient was referred for surgical intervention by the oral and maxillofacial surgery department.
Discussion The differential diagnosis of lesions can be aided by DWI and ADC values. T2 shine-through, as seen in this case, manifests as hyperintensity on both DWI-TRACE and ADC images, distinct from diffusion restriction. This phenomenon arises from prolonged T2 decay time in specific tissues. Similar instances have been noted in epidermoid cysts and, as illustrated here, in a plunging ranula.
Conclusion Dentomaxillofacial radiologists should be attuned to the T2 shine-through effect, which can lead to misinterpretation when assessing lesions using DWI-TRACE and ADC sequences. This case underscores the need for accurate differentiation between diffusion restriction and T2 shine-through, enabling informed treatment choices.

Keywords Apparent diffusion coefficient, Diffusion weighted imaging, Magnetic resonance imaging, Plunging ranula, T2 shine-through

Introduction

Ranulas, also known as mucocele, mucus extravasation, or retention cyst, are rare intraoral non-odontogenic cystic lesions that can affect the patient in any decade. Since ranulas lack an epithelium lining like true cysts and instead have a lining formed by connective tissue and granulation, they should be identified as pseudocysts. They form with extravasation of mucus inside a cavity associated with the sublingual gland. There is no gender preference for the lesion. Although the etiology is unclear, the most common reason was reported as trauma to an excretory duct. Two different ranula types are identified as simple ranulas and plunging (deep) ranulas (PR), as they have different clinic features and localizations (1-3). Simple ranulas develop in conjunction with the caruncula sublingualis at the affected side, whereas extravasated mucin in PRs perforates m. mylohyoideus and extends to the neck. Although bilateral ranulas were reported in various case reports in the literature, ranulas are mostly unilateral. Intraoral examination typically reveals a bluish, fluctuant, painless lump that can grow to several centimeters in diameter. The preferred course of therapy is complete excision, which includes removal of the damaged salivary duct as incomplete excision can cause recurrence of the lesion (1-7).

Magnetic Resonance Imaging (MRI) is known for its superiority in revealing the extension and the internal structure of the lesions of the head and neck region with fruitful information about the affected surrounding structures (8). As MRI can distinguish the characteristic radiographic features of PRs with a specific sign described as the "tail sign", those lesions can be examined without exposing the patient to any ionizing radiation. T2 sequences of MRI can easily highlight the solid lesion's non-solid fragments and the cystic lesions' whole internal structure, leading to precise radiographic evaluations for the radiologists (9, 10).

MRI is becoming a standard imaging method for evaluating both odontogenic and non-odontogenic cystic lesions and tumours of the head and neck region, and diffusion-weighted imaging (DWI) is shown to be beneficial for differentiating those lesions such as odontogenic keratocyst and ameloblastomas (11, 12). As there is a confusing similarity between the early unicystic ameloblastomas and odontogenic keratocysts, the differential diagnosis may become tricky, which makes it harder for the oral and maxillofacial surgeons to plan the appropriate treatment. DWI is valuable in evaluating the cyst and tumour according to their apparent diffusion coefficients (ADCs). If a lesion demonstrates significantly lower ADC values, it shows that the lesion has a diffusion restriction which suggests a solid lesion (13, 14).

In some cases, both ADC and isotropic diffusion mapping reveal a hyperintense lesion which is known as T2 shine-through. T2 Shine-through occurs when a high signal on isotropic diffusion mapping is not due to diffusion restriction but rather to a higher signal in the T2 sequence. This mainly happens as some tissues have a long T2 decay time (15). This phenomenon can be seen in lesions such as epidermoid cysts, and in our case, it was also seen in a plunging ranula case; thus, this case report aims to demonstrate a case of T2 shine-through with a PR's MRI and clinical features.

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Case Report

A 16-year-old male patient was referred to our clinic with an expansion at the left submandibular space and a painless intraoral cystic lesion that is localized at caruncula sublingualis that occurred around a month ago (Figure 1). Due to its characteristic localization and clinical features, PR was considered in the differential diagnosis. In order to see the exact extension and morphology of the lesion, MRI was planned.

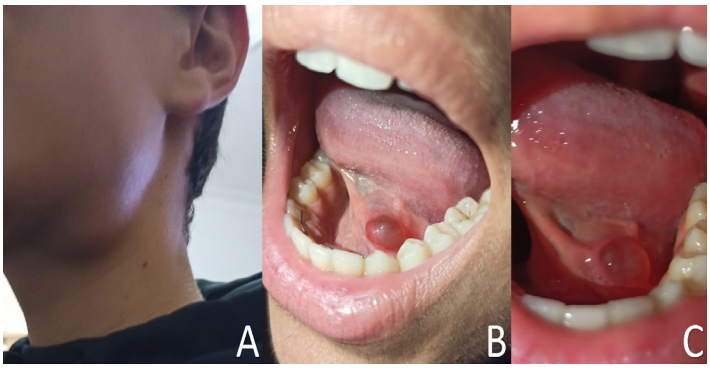

Figure 1: Extraoral image of the patient that caused expansion at the left submandibular space (A), Intraoral image of the cystic lesion at caruncula sublingualis. Note the fluid appearance in the lesion (B-C).

Axial (Figure 2) and sagittal (Figure 3) MRI slices revealed a hypointense, well-defined lesion in T1-Turbo Spin Echo (TSE) images (TR:617, TE:9.90) and a hyperintense, well-defined lesion that extends from the sublingual gland and herniates through musculus mylohyoideus to the submandibular space with a characteristic tail sign in T2-TSE (TR:839, TE:2164) and T2-TSE Fat-Saturated images (TR:814, TE:1798). The lesion had even higher signal intensity in T2-TSE Fat-Saturated images. Diffusion-weighted (DWI) TRACE images at b=1000s mm-2 (TR:5000, TE:101) and apparent diffusion coefficient (ADC) images (TR:5000, TE:101) both showed a hyperintense lesion that suggests the presence of a T2 Shine-Through case (Figure 4).

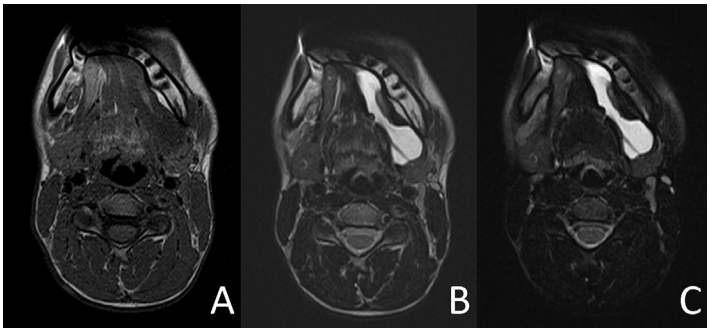

Figure 2: Hypointense, well-defined lesion is seen in T1W-TSE (TR:617, TE:9.90) axial slice (A), Hyperintense well-defined lesion that extends from the sublingual gland to the submandibular space is seen in T2W-TSE (TR:839, TE:2164) and T2-TSE-FATSAT (TR:814, TE:1798) images. Note that this appearance is known as the tail-sign appearance (B-C).

Fine-needle aspiration cytology and imaging characteristics of the lesion were evaluated together, and the lesion was defined as a plunging ranula. The patient was referred to Oral and Maxillofacial Surgery for surgical treatment.

Discussion

A diffusion tensor is an array of numbers in a 3x3 matrix that represents the various diffusion coefficients of anisotropic biological tissues. TRACE term, as in DWI-TRACE, represents the sum of diagonal elements of such an array and the average of this TRACE value. The intensity of the signal of each voxel in DWI-TRACE images has an inverse relationship with the Apparent Diffusion Coefficient (ADC) value. In the presence of the diffusion restriction, such as in abscesses and malignant lymph nodes, DWI-TRACE images reveal hyperintense areas, and ADC images reveal hypointense areas. On the other hand, in the absence of diffusion restriction, such as in CSF, DWI-TRACE images reveal hypointense areas while ADC images reveal hyperintense areas. As DWI-TRACE images also involve significant T2W, lesions with very long T2 values may appear hyperintense as they appear in ADC images. This condition is known as "T2 Shine-Through" and when present, both T2 and ADC images should be examined to check for conformation (15-20). Colagrande et al. suggested that T2 shine-through effect can be lowered by using greater b values (21).

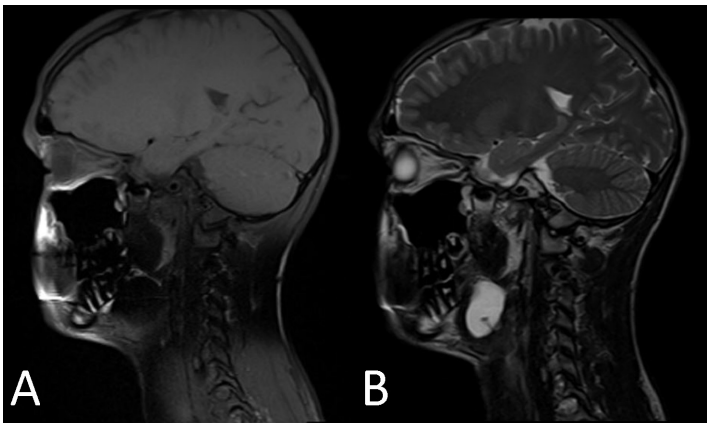

Figure 3: Hypointense, well-defined lesion is seen in T1W-TSE (TR:617, TE:9.90) axial slice (A), Hyperintense well-defined lesion that extends from the sublingual gland to the submandibular space is seen in T2W-TSE (TR:839, TE:2164) image. Note that this appearance is known as the tail-sign appearance (B).

In order to discuss the significance of this phenomenon, both for the pitfalls and differential diagnosis, a brief review of the literature was performed. Thirty-nine articles were found in the PubMed database; however, only two described T2 Shine-Through in the head and neck region. The majority of the cases were about lesions and ischemic strokes of the brain and the tumours of the liver. The articles that presented cases in the head and neck regions were published by Hibino et al. (22) in 2017 and Chawla et al. (15) in 2009.

Hibino et al. reported an 18-year-old patient who referred to them with a four-day history of neck pain and fever (40.2^{O} C). The patient had an incomplete Kawasaki Disease, and he had oral and pharyngeal mucositis with bilateral cervical lymphadenopathy. They performed an MRI and reported a hyperintense area in T2W, ADC, and DWI-TRACE sequences in the retropharyngeal region that was suggesting retropharyngeal edema which was mimicking a retropharyngeal abscess. They discussed that the hyperintense appearance on DWI-TRACE sequences was not caused by restrict-

ed diffusion but by a high T2 signal that is commonly observed in vasogenic edema (22).

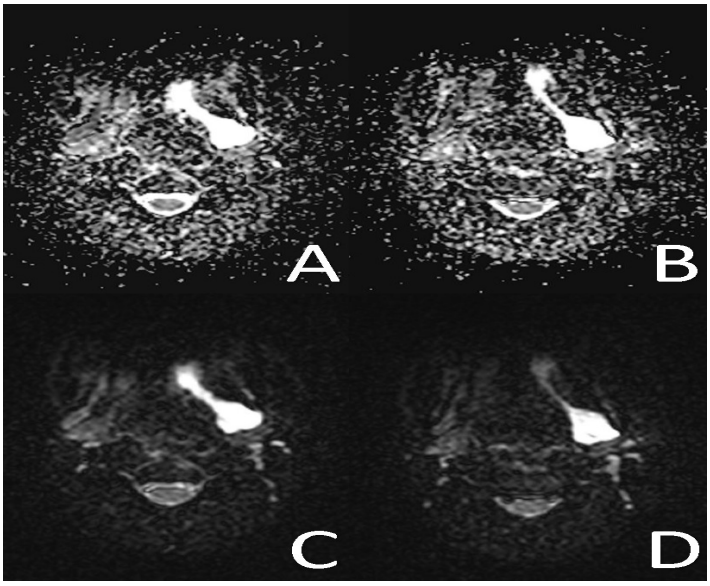

Figure 4: DWI-TRACE images at b=1000s mm-2 (TR:5000, TE:101) (A-B), and ADC images (TR:5000, TE:101) both revelead a lesion with a high signal as it was in T2W sequence (C-D).

Chawla et al. conducted a review in order to evaluate the utility of DWI in the diagnosis, prognosis, and monitoring of the treatment responses in the head and neck region. They stated that DWI images should be interpreted with attentiveness and should be evaluated with ADC maps as T2 shine-through effect may cause misdiagnoses and mimic another pathology (15).

To the best of our knowledge, this case report presents the first instance of the T2 shine-through phenomenon observed in an intraoral lesion. Dentomaxillofacial radiologists should be more familiar with the concepts and glossary of MRI terms to avoid pitfalls and enhance differential diagnosis.

Conclusion

T2 Shine-Through phenomenon can be seen in lesions such as epidermoid cysts in maxillofacial region. In the present case, this phenomenon was also seen in a plunging ranula; thus, dentomaxillofacial radiologist should be aware of this finding as it may cause confusion since DWI-TRACE and DWI-ADC sequences will both present the lesion as hyperintense.

Declarations

Author Contributions: *Conception/Design of Study- G.Ü., R.B.K.; Data Acquisition- G.Ü., R.B.K.; Data Analysis/Interpretation- G.Ü., R.B.K.; Drafting Manuscript- G.Ü., R.B.K.; Critical Revision of Manuscript- G.Ü., R.B.K.; Final Approval and Accountability- G.Ü., R.B.K.; Material and Technical Support- G.Ü., R.B.K.; Supervision- G.Ü.*

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