PICTORIAL ESSAY | Head and Neck Imaging

Stages of submasseteric space infection: a pictorial review

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ABSTRACT

The submasseteric space is described as merely a potential closed place between the mandible and the masseter muscle. However, in situations where infective organisms find their way to this space, it would provide a protected environment for the development of occult infection. Infection within the submasseteric space is rare, often chronic and commonly misdiagnosed or missed. Recognising this potential space infection which is commonly dental in origin and identifying its important clinical and radiological findings, are essential for an appropriate and timely diagnosis and management that usually requires surgical drainage to alleviate the symptoms.

Our objective in this article is to describe the anatomy of the submasseteric space and present a pictorial review describing the clinical and radiological features of the infection in the acute, subacute and chronic stages.

KEY WORDS: Submasseteric space, odontogenic infection, pericoronitis, MRI, CT, phlegmon

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Introduction

The submasseteric space is a potential space between the masseter muscle and the ramus of the mandible yet it acts as a protected environment for the development of occult infections and abscesses (1).

Submasseteric space infections are rare and often misdiagnosed or missed (2). The submasseteric space infections are mostly odontogenic in origin, as a sequela of pericoronitis - an inflammation of the gum surrounding the crown of a non-erupted impacted molar tooth, commonly the third molar mandibular tooth (3). Intravenous antibiotics often fail to relieve the symptoms as this is a closed space and results in chronic infection that often need surgical intervention and drainage (4).

We describe the anatomy of this potential space and present a pictorial review describing the clinical presentation as well as the radiological findings in the acute, subacute and the chronic stages of the infection.

Anatomy

The submasseteric space is one of three spaces that make up the main masticator space. The other two are the temporal and the pterygomandibular spaces. The masticator space is formed by the division of the superficial layer of the deep cervical fascia that encloses the mandible and the muscles of mastication. The contents of this space include the masseter, the tendinous insertion of the temporalis, medial and lateral pterygoid muscles, the ramus and posterior body of the mandible and the inferior alveolar nerve and vessels (5).

The masseter muscle originates from the zygomatic arch and divided into three parts: superficial, middle, and deep [Figure 1A-D and 2].

Hohl et al (6) have pointed out that there is an area of loose muscle insertion at the mandible which facilitate abscess formation. Whereas Bransby-Zachary who first described the submasseteric space in 1948 (7), reported a true space lateral to the ramus of the mandible as a bare area between the separate attachments of the deep and middle parts of the masseter muscle, creating a potential space. The smaller deep part of the muscle insertion is limited to the lateral surface of the coronoid process and upper third of the mandibular ramus. The largest, superficial part is restricted to the lower third of the ramus, at the angle of the mandible. The middle portion has a thin and small insertion along the middle third of the ramus curving posteriorly and superiorly [Figure 2].

Anteriorly, the submasseteric space is confined by the inner surface of the masseteric fascia as it wraps around the anterior margin of the masseter muscle and the ramus. In this location, the space is closely related to the retro-molar trigone. Posteriorly, the space is in close proximity to the parotic gland limited only by the fibromuscular fascia, and laterally bounded by the fibres of the masseter muscle. Medially, the space is bounded by the periosteum of the lateral aspect of the ramus. Inferiorly, it is limited by the insertion of the masseter muscle along the inferior third of the ramus, and superiorly, it communicates with the superficial temporal space [Figure 1A-D].

Effectively the submasseteric space is a closed space with no natural outlet for spontaneous drainage and inadequately treated infections in this area can rapidly progress to abscesses.

Acute submasseteric space infection

Acute presentation of submasseteric space abscess [Figure 3A and B] is the sequelae of posterior migration of organisms from an infected mandibular third molar tooth during extraction or as a result of needle contamination from buccal and mandibular block injections (8,9). Clinical presentations that help to suspect the condition include lateral cheek swelling, redness of skin and trismus. Signs of systemic infection are often absent and can be mistaken for parotid infection, however the location of the infection over the mandible and the presence of trismus can help to differentiate the former from the later (2,10). Radiologically, a collection just lateral to the ramus of the mandible and deep to the enlarged masseter muscle can be readily demonstrated on CT (computed tomography) and MRI (magnetic resonate imaging) examination.

Subacute submasseteric space infection

Patients presenting with subacute symptoms are initially misdiagnosed. These patients usually suffer from episodic facial pain and swelling for a period of weeks up to 6 months (1). There is usually a firm, relatively painless, non-fluctuant facial swelling with progressive trismus that may mimic tumour or TM joint dysfunction

On CT studies, the typical fluid collection is not usually identified. Masseteric thickening and phlegmonous low-attenuation area without enhancement lateral to the mandible can be demonstrated. Phlegmon is differentiated from abscess by failing to identify a walled in, peripherally enhancing collection characteristic of an abscess. A phleg-

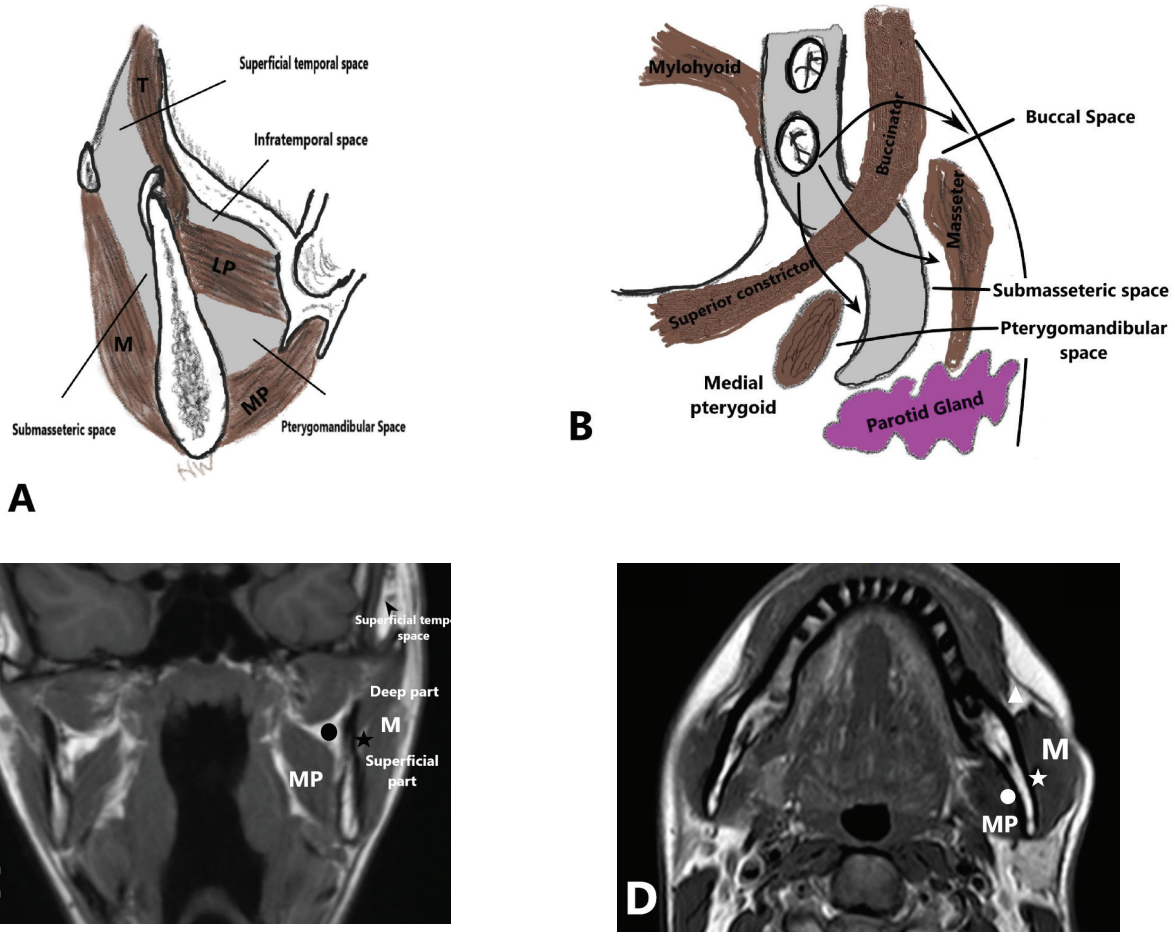


Figure 1A-D: *Coronal (A & C) and axial (B & D) schematic views and representative magnetic resonance imaging (MRI T1 weighted) demonstrating the submasseteric space and its relation to the mandible and the muscles of mastication. LP: Lateral pterygoid muscle, MP: medial pterygoid muscle, M: masseter muscle, T: temporalis muscle. Curved arrows: routes of infection. Star * : submasseteric space, Circle ●: pterygomandibular space, Triangle ▲ : buccal space.*

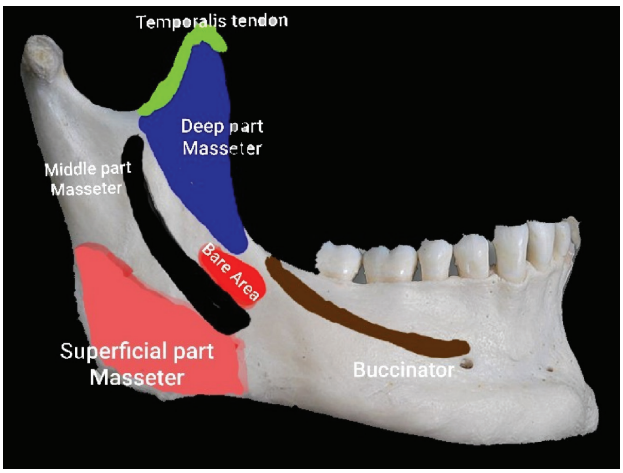


Figure 2: *The submasseteric space (Bare Area) results from the division of the masseter muscle attachment to the mandible into three parts: superficial, middle and deep.*

mon can turn in abscess if not appropriately treated. The CT examination can also impressively display sclerosis of the underlying mandibular ramus, providing a clue for an underlying infection when coupled with identifying overlying muscle inflammation (1, 9).

MRI studies are more readily capable of illustrating the masseteric inflammation early in the process, demonstrating the abnormal signal intensities and enhancement on both T1 and T2 weighted images [Figure 4A and B].

Chronic Submasseteric Space Infection

Osteomyelitis of the mandible secondary to odontogenic infection is usually due to pericoronitis of the third mandibular molar tooth. Low grade osteomyelitis is thought to develop as a result of the continued presence of a sub-per-

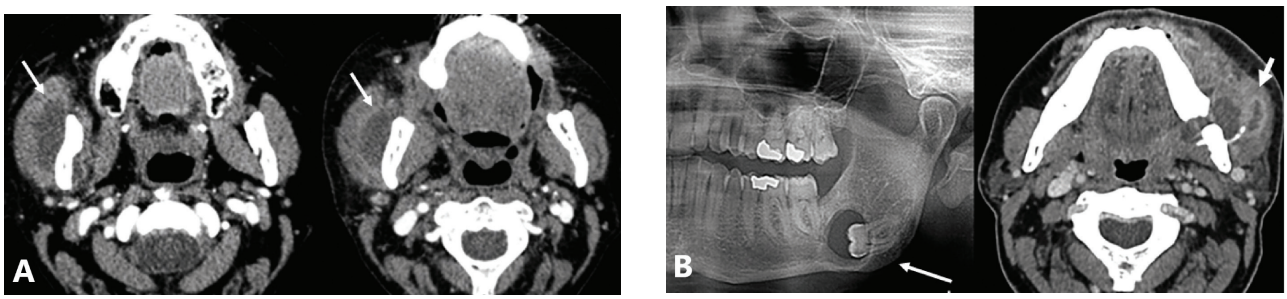


Figure 3A: *Axial post contrast soft tissue window CT image demonstrating acute right sided submasseteric abscess (arrow) in a patient presenting to the Emergency Department with pain & swelling in the right cheek with recent history of extraction of the right mandibular third molar tooth.*

Figure 3B: *Plain radiograph of the left mandible demonstrates an infected dental cyst (arrow) which can also present acutely. Axial post-contrast CT of the same patient shows the infection involving not only the submasseteric space but extends into the substance of the masseter muscle as well (small arrow).*

iosteal submasseteric infection / abscess compressed against compact bone with subsequent intraosseous involvement. Patients are usually presented with painless swelling without fever or significant trismus (1). CT examination is useful in identifying the bony sclerosis, suggesting osteomyelitis. MRI can demonstrate subtle sub-periosteal abscess or phlegmon that acts as a nidus of infection with continued bony reaction and eventual sclerosis and destruction [Figure 5A and B].

Discussion

The submasseteric space is a subdivision of the larger masticator space (1). Odontogenic infections most commonly present with intra-oral manifestation and abscess formation is rare. However, the submasseteric space has virtually no outlet and inadequately treated infections can progress to abscess formation (3). Although several routes of infection in this region are possible, Bransby-Zachary suggests that pericoronitis associated with the third molar infection is probably the most frequent cause (5). The posterior part of the crown and follicle of those teeth are often situated beyond the buccinator muscle insertion along the alveolar ridge and closely related to the anterior margin of the submasseteric space (10).

Infection usually follows extraction or dental procedures of the third mandibular molar or inoculation of bacteria or normal oral flora via anaesthetic needles (8,9). Clinical examination can be limited in the presence of trismus.

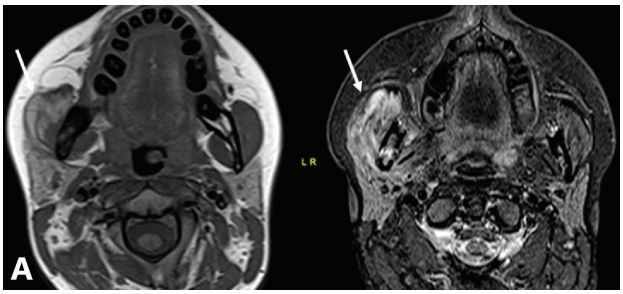
Many organisms can lead to such abscesses and could be either aerobic like α haemolytic streptococci, Staphylococcus, Streptococcus pneumoniae, Enterobacteriacae, Proteus, Klebsiella and Mycobacterium tuberculosis (11), or anaerobic such as Bacteroides, Prevotella and Fusobacterium (4,9). Bernanrd et al (12) described a rare masseteric actinomycosis and believed to have been introduced from the normal oral flora into the muscle via the anaesthetic needle.

The severity of the infection and the clinical presentation are therefore dependent on the causative organisms and their virulence as well as the stage of the disease. The commonly recognised symptoms include facial swelling, pain secondary to abscess collection in a closed space, trismus from inflammation of masseter muscle, malaise and fever (4).

Submasseteric abscess is often misdiagnosed and the typical findings of an abscess are usually lacking. Findings of masseteric enlargement and bony sclerosis of the mandible should raise suspicion for an underlying infection (1).

Imaging therefore, plays a vital role in diagnosing this condition especially in the subacute and chronic phase of the disease and the usual radiologic signs of acute infection, such as rim enhancement and infiltration of adjacent tissue planes are not usually apparent. One theory suggests that the chronic nature of the infections may result in increased attenuation of the pus and become iso-attenuating relative to the muscle on CT studies (1).

CT examination with contrast is the radiological study of choice for the assessment of submasseteric space infection, especially in the acute presentation. CT has the ability to depict both soft tissue and bone abnormalities.



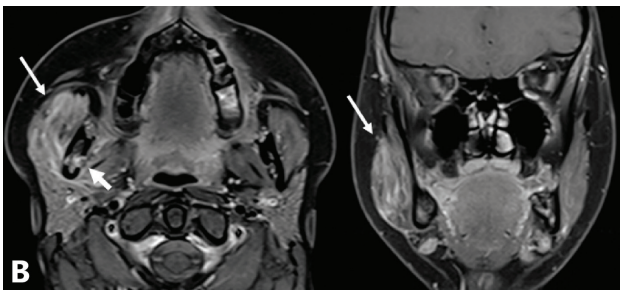
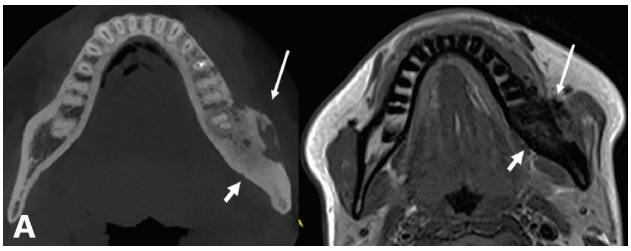


Figure 4A: *Axial T1 and T2 STIR weighted images. Patient with recurrent right lateral cheek swelling treated with antibiotics for presumed parotid infection. MRI performed to exclude temporomandibular (TM) joint dysfunction. There is swelling of the right masseter muscle (arrow) with heterogeneous signal intensities on both images, suggesting inflammation. No discrete collection is identified.*

Figure 4B: *Axial and coronal post-contrast T1 weighted fat saturated MR images fail to demonstrate a definite pocket of abscess. There is a focus of enhancing tissue extends through a cortical defect on the lingual surface of the right mandible (small arrow). Findings of diffuse masseteric enlargement and bony involvement should suggest the presence of an infectious process.*



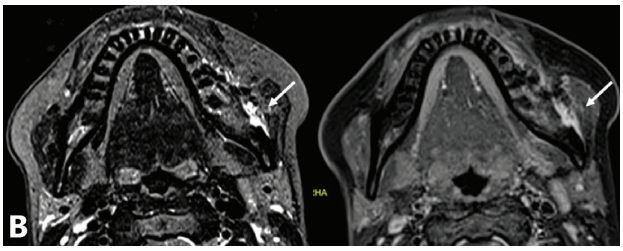


Figure 5A: *Case of 'non-resolving' osteomyelitis of the left mandible. CBCT and T1 weighted MRI images show bone destruction along the buccal cortex (long arrow) as well as sclerosis (short arrow). Patient gave history of previous third molar infection & subsequent extraction. CBCT: Cone-beam computed tomography.*

Figure 5B: *Axial T2 STIR and post-contrast T1 weighted with fat saturation MR images better demonstrate a submasseteric abscess (long arrow) which acts as a nidus of infection that induces the bony changes. Bone changes can be subtle in the early stages and MRI is better to delineate the soft tissue abnormality.*

Thickening of the masseter muscle with submasseteric collection can be demonstrated. Bone sclerosis and destruction are better shown on bone window images. MRI studies are however more sensitive than CT for the assessment of soft tissue changes due to the characteristic superior soft tissue contrast resolution and the ability to illustrate soft tissue inflammation early and more consistently than CT as well as the ability to differentiate inflammation from other possible neoplastic processes, a key in making accurate diagnosis. Bone marrow involvement can be readily seen on MRI as bone thickening and decreased signal intensity on T1 weighted images, cortical discontinuity and enhancement on the post contrast images. Therefore, MRI is considered the preferred modality particularly when a protracted and chronic cases of inflammation are suspected (1, 13)

Ultrasound (US) is a useful, non-invasive tool in demonstrating the submasseteric space abscess. It can reveal the internal muscular septae or bands more clearly than CT. Masseteric thickening and reduction of the echogenicity of the muscular structure are recognised finding in inflammatory process (14). It can also detect an irregular hypoechoic collection in the masseter muscle with or without mass effect to the nearby parotid gland. Ultrasound guided drainage of a submasseteric abscess offers both diagnostic and therapeutic method and a practical alternative to surgical drainage which can be done in an outpatient setting without the need for general anaesthesia or unsightly skin incisions (15).

Conclusion

Submasseteric space infections are rare, often chronic and misdiagnosed as parotid abscess or parotitis. The cause is commonly dental in origin. Three stages of infection can be recognised and different clinical and radiological presentations can assist in the diagnosis. The radiologic findings concerning this condition are limited and CT may fail to demonstrate the typical findings of an abscess, particularly in the subacute and chronic stages. Combining clinical symptoms of masseteric enlargement, trismus and radiological bony sclerosis of the mandibular ramus should raise suspicion. MR imaging will frequently and promptly show the signs of inflammation such as fluid collection, abnormal muscular signal intensity and bone marrow signal changes, expediting diagnosis and treatment. Finally, ultrasound is an excellent widely available and non-invasive alternative tool for directing abscess drainage when surgical options are limited, providing a combined diagnostic and therapeutic benefits. **R**

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