Magnetic Resonance Imaging of Acute Head and Neck Infections

Neil Thayil, MD[a], Margaret N. Chapman, MD[a,b], Naoko Saito, MD, PhD[c], Akifumi Fujita, MD, PhD[d], Osamu Sakai, MD, PhD[a,*]

KEYWORDS

• Infections • MR imaging • Head and neck • Complications

KEY POINTS

- The severity of head and neck infections can often be ascertained from the clinical history and physical examination.
- In some sinus and periorbital infections, MR imaging is crucial for identifying spread of infection into the orbital and intracranial compartments and helps to guide management.
- MR imaging is unsurpassed in its ability to identify and evaluate complications of middle ear and temporal bone infections.
- MR imaging detects osteomyelitis and is useful to differentiate osteomyelitis from acute bone infarction in the setting of sickle cell disease.
- MR imaging is an invaluable tool to pinpoint the exact origin and extent of retropharyngeal and prevertebral infections and to identify possible associated complications.

INTRODUCTION

Acute head and neck infections can evolve as slowly progressive smoldering processes, or advance as rapidly debilitating entities with clinical consequences that can often be life threatening. The clinical presentation of the infectious process in question varies depending on the specific head and neck compartment that is primarily affected. The severity and aggressive nature of the disease process can usually be sufficiently elucidated though the clinical examination and history.

Imaging is often relied upon to assist in the evaluation of the anatomic extent of the acute infection and to identify any pertinent complications that could contribute to patient morbidity and mortality if left unidentified and untreated. Although computed tomography (CT) is the first-line modality in the acute setting of many uncomplicated infectious processes, MR imaging is the modality of choice in examining the exact scope of certain complicated infections owing to its superior delineation of soft tissue contrast, particularly when intracranial complications are suspected. MR imaging is unquestionably the modality of choice for high-resolution evaluation of multiple entities including facial neuritis, optic neuritis, labyrinthitis, petrous apicitis, and acute osteomyelitis. MR imaging is also a valuable tool to evaluate the bone marrow and differentiate between entities such as osteomyelitis and bone infarct. MR imaging also detects vascular complications caused by acute infections, such as sinus venous thrombosis. The ability to identify these dreaded complications and drastically influence clinical management confirms the utility of MR imaging in the evaluation of acute head and neck infections.

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[a] Department of Radiology, Boston Medical Center, Boston University School of Medicine, FGH Building, 3rd Floor, 820 Harrison Avenue, Boston, MA 02118, USA; [b] Radiology Service, VA Boston Healthcare System, 1400 VFW Parkway, West Roxbury, MA 02132, USA; [c] Department of Radiology, Saitama International Medical Center, Saitama Medical University, 1397-1 Yamane, Hidaka, Saitama 350-1298, Japan; [d] Department of Radiology, Jichi Medical University School of Medicine, 3311-1 Yakushiji, Shimotsuke, Tochigi 329-0498, Japan
* Corresponding author.
E-mail address: osamu.sakai@bmc.org

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This article discusses the use of MR imaging in various acute infectious diseases of the head and neck, with particular emphasis on situations where MR imaging provides additional information that can significantly impact treatment decisions and outcomes. MR imaging findings of various disease processes are discussed, based on the head and neck compartments from which they originate. Specifically, infectious entities of the orbit, paranasal sinuses, pharynx, oral cavity (including periodontal disease), salivary glands, temporal bone, and lymph nodes are described in detail.

ORBITS

Periorbital and Orbital Infections

The orbital septum is the anatomic landmark that distinguishes the periorbital (preseptal) tissues from the orbit proper (postseptal tissues). The orbital septum is a thin membranous sheet extending from the orbital periosteum. Superiorly, it inserts and blends with the aponeurosis of the levator palpebrae superioris, and inferiorly it blends with the tarsal plates. This structure is not readily demonstrated on imaging, but it serves as a barrier to posterior spread of infections from the periorbital tissues into the orbit proper.[1–3]

Periorbital cellulitis typically occurs secondary to a nearby sinonasal, facial, or dental infection that spreads to involve the periorbital tissues. Local trauma may also serve as an etiology. Typical presenting symptoms include pain, eyelid swelling and erythema, conjunctivitis, and fever. On MR imaging, periorbital cellulitis usually manifests as edema, soft tissue swelling, and diffuse periorbital soft tissue enhancement. A loculated abscess within the periorbital or surrounding facial soft tissues may also be present.[3–5]

In contrast, orbital cellulitis usually results as a complication of adjacent paranasal sinusitis (**Fig. 1**) and occasionally from a dental infection.[6] Embedded posttraumatic foreign bodies can also contribute to this process. Typical presenting symptoms are similar to periorbital cellulitis, with the addition of proptosis as a predominant feature.[3,4] Orbital cellulitis is associated with an increased risk of devastating neurologic sequelae, including ophthalmic vein thrombosis, venous sinus thrombosis, mycotic aneurysm, meningitis, and intracranial abscess.[2,3] Thus, identifying an infection in the orbit is of paramount importance to help guide management and prevent poor outcomes.

The MR imaging findings of orbital cellulitis include fat stranding and rim-enhancing abscess formation, which can be intraconal or extraconal (often subperiosteal) and edema and abnormal enhancement of the extraocular muscles.[3,5] Noninfectious conditions, including idiopathic orbital inflammatory syndrome ("pseudotumor"; **Fig. 2**), and immunoglobulin G4 (IgG4)-related disease can mimic this infection. Grave's ophthalmopathy is also a differential consideration, but can be differentiated by noting the classic sparing of the tendinous insertions.[3]

Treatment of orbital cellulitis typically involves hospital admission with administration of intravenous antibiotics and possible drainage of loculated orbital collections, if present. In contrast, uncomplicated periorbital cellulitis can be treated on an outpatient basis with oral antibiotics.[3]

Of note, dacryocystitis is an infection that results from obstruction of the medial nasolacrimal duct that can be complicated by periorbital and, rarely, orbital cellulitis. Infection from *Streptococcus pneumoniae* accounts for almost 25% of the cases, although other microorganisms from the *Streptococcus* and *Staphylococcus* families can also be responsible.[7,8] Typical clinical presentation involves focal swelling along the medial canthus, conjunctivitis, and purulent drainage. MR imaging may demonstrate a dilated fluid-filled lacrimal sac along the medial canthus with peripheral rim enhancement on postcontrast images. When clinical assessment is limited owing to concurrent periorbital and orbital cellulitis, the value of MR imaging is its ability to accurately depict these complications. Treatment may be either medical or surgical, depending on patient symptomatology and the presence of associated complications.[3,8]

PARANASAL SINUSES

Bacterial Infection

A variety of organisms have been implicated as causes of acute and chronic sinusitis, including *S pneumoniae* and other *Streptococcus* strains, *Staphylococcus aureus*, *Moraxella catarrhalis*, *Pseudomonas* species, particularly in immunosuppressed and diabetics, and anaerobic bacteria.[9] Differentiating between acute and chronic sinusitis can only be made by considering the timeframe during which it has been present. Inflammation of the paranasal sinus mucosa present for fewer than 4 weeks is defined as acute sinusitis, whereas chronic sinusitis refers to disease that is present for longer than 12 weeks.[9] Both entities clinically present with nasal congestion, purulent discharge, headache, maxillary and dental pain, and reduced sense of taste or smell.

Imaging is not typically necessary to diagnose sinusitis, particularly in the acute phase. Although CT is the first-line modality, MR imaging can be performed when intracranial or intraorbital complications are suspected clinically. MR imaging is sensitive in identifying inflammation of the paranasal