Infratemporal Fossa Abscess Drainage via a Trans-Oral Image Guided Approach

Case Report

Adam Morin, Matthew J. Urban, Samer Al-Khudari

Department of Otolaryngology, Rush University Medical Center, Chicago, United States

Abstract

Deep neck space infections can cause antibiotic-resistant abscesses that can impinge on vital anatomical structures. Image-guided surgery systems using preoperative computed tomography (CT) imaging can be utilized to characterize pathology and assist surgeons in avoiding iatrogenic injury. This manuscript explores the presentation and unique CT-guided surgical management of an infratemporal fossa abscess in a 48-year-old male who presented with left-sided dental pain and facial swelling that had progressed despite antibiotics and dental extraction. CT-guided imaging can assist in localizing and protecting vital anatomical structures during deep neck abscess drainage and can prevent the potential risks and complications of classic surgical approaches.

Keywords: Deep neck abscess, head and neck surgery, image-guided surgery systems, infratemporal fossa, case report

ORCID IDs of the authors:

A.M. 0000-0001-7266-762X;
M.J.U. 0000-0001-5889-5810;
S.Al-K. 0000-0002-4160-7496.

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Corresponding Author:
Samer Al-Khudari;
samer_al-khudari@rush.edu

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Introduction

Deep neck space infections (DNSI) may result in severe complications including mediastinitis, airway obstruction, respiratory distress syndrome, aspiration pneumonia, septic shock, disseminated intravascular coagulation, or death (1, 2). DNSI can have major consequences on the integrity of critical anatomical landmarks within the surrounding vicinity. Surgical intervention is indicated for abscesses that fail to respond to antibiotics; however, special care and delicate surgical maneuvers are required to preserve anatomical structures that are not clearly distinguishable. Image-guided surgery systems using preoperative computed tomography (CT) imaging have increasingly been utilized to characterize pathology and assist surgeons in avoiding iatrogenic injury (3, 4). For example, CT imaging has aided in the diagnosis of retropharyngeal abscesses and the indication for surgical drainage in children based on a series of 18 cases (5). CT-guided imaging has long been established for diagnosing various pathologies; however, it has only recently become utilized intraoperatively, especially in our case for guidance in deep neck abscess drainage. While much of the literature on CT-guided surgery in otolaryngology focuses on endoscopic and transnasal approaches, our manuscript reports a unique, image-guided intraoral drainage of an infratemporal fossa (ITF) abscess (6). The primary objective of this work is to report on the minimally invasive approach and review the role of image-guided surgery in the management of DNSI.

Case Presentation

The patient is a 48-year-old male who had no significant medical history and presented

with three weeks of left-sided dental pain and facial swelling that had progressed despite oral antibiotics, intravenous antibiotics, and dental extraction. Physical examination revealed tender edema of the left buccal space extending high over the lateral temporal region, significant trismus, and minimal purulent drainage descending across the left oral vestibular fornix. CT imaging demonstrated a 1.2-cm abscess ascending along the lingual cortex of the left ramus with a separate 2.1-cm abscess in the left ITF and surrounding inflammatory changes (Figures 1a, b). Needle aspiration of both sites (intraoral and transtemporal, respectively) appeared to resolve the abscess along the mandible, but the patient's temporal pain, trismus, and leukocytosis persisted. The decision was then made to proceed with operative drainage of the infection under anesthesia. The patient was hemodynamically stable, informed consent was obtained, and the team proceeded to the operating suite for a left ITF abscess incision and drainage with intraoperative CT image guidance.

The patient was prepped and draped in the usual sterile fashion after nasal fiberoptic intubation with maxillofacial CT image registration (Medtronic Fusion System, Minneapolis, Minnesota, United States). The intraoral approach was initiated via a horizontal mucoperiosteal incision 5 mm above the mucogingival junction over the left maxilla. Subperiosteal dissection proceeded posteriorly towards the pterygomaxillary fissure. At this time, visualization was limited, and blind dissection was halted to avoid neurovascular injury. The image-guided Frazier tip suction and probe were bluntly directed toward the ITF abscess under live image localization and confirmed in 3-dimensions (Figure 2). A rush of purulent exudate was released via blunt dissection with the seeker probe and cultures were sent for examination. The area was irrigated copiously, ½-inch iodoform packing was placed in the abscess cavity, confirmed by image guidance, and the anterior 75% of the mucoperiosteal incision was closed with a dissolvable suture. Empiric antibiotics (vancomycin/piperacillin-tazobactam) were continued. All cultures resulted in no bacterial growth. The patient's symptoms and laboratory findings improved throughout the hospital course, and the patient was discharged on postoperative day three. The CT performed one month postoperatively showed complete resolution of both abscesses (Figures 3a, b) and the patient's symptoms resolved at three months during follow-up with mild referred otalgia on full mouth opening or yawning. Trismus improved measuring over two cm mouth opening. The patient is well-healed and improved overall. Informed consent for this case report was obtained from the patient.

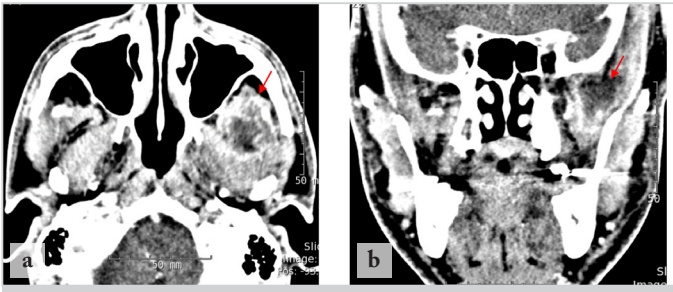

Figure 1. Preoperative CT scans: **a.** Axial CT view showing the clear borders of a 21x19 mm abscess in the left infratemporal fossa along the temporalis muscle with surrounding edema and inflammatory changes. **b.** Coronal CT view of the left infratemporal fossa abscess
CT: Computed tomography

Discussion

Abscess drainage using image-guided techniques such as ultrasound is widely accepted for superficial abscesses. However, ultrasound is limited for deeper locations, such as in the ITF, as was in our case. The 3-dimensional view provided by CT-guided navigation minimizes dissection and the risk of injury to nearby neurovascular structures and enables a precise surgical approach with a minimal error range (7, 9). Precision is crucial in our case as important

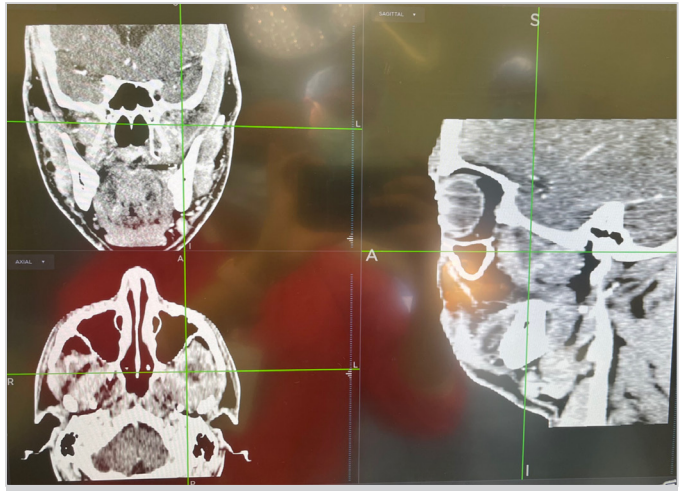

Figure 2. Intraoperative CT-guidance imaging: The image-guided Frazier tip suction and probe are shown in the infratemporal fossa abscess under live image localization using intraoperative CT-guided imaging in coronal, axial, and sagittal views
CT: Computed tomography

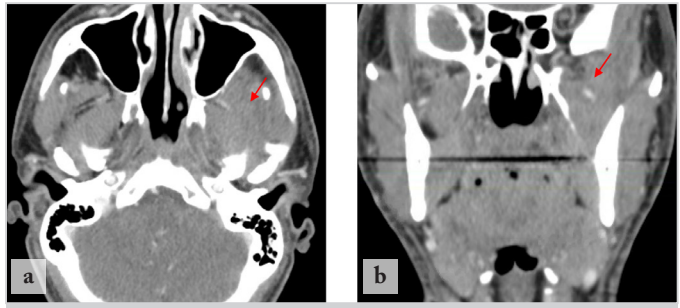

Figure 3. CT scans post-operation: **a.** Axial CT view showing complete resolution of the infratemporal fossa abscess. **b.** Coronal CT view showing complete resolution of the infratemporal fossa abscess
CT: Computed tomography

anatomical structures surround the surgical site including the inferior alveolar bundle, lingual nerve, second branch of the trigeminal nerve, internal maxillary artery, pterygoid plexus of veins, and posterior temporal artery. In our case, image guidance facilitated a minimally invasive trans-oral "keen" approach by allowing for the precise location of the abscess. On initial dissection, without the use of the image-guided probe, localizing the relatively small fluid collection was very difficult. CT-guided navigation allowed us to confirm the location of the abscess in real-time using the seeker tracker to accurately drain it. Without image-guided technology, this infection likely would have necessitated an open Gillies trans-temporal approach with heightened risk to the frontal branch of the facial nerve. CT-guided imaging can assist in the drainage of deep neck abscesses that are difficult to locate and surrounded by vital anatomical structures. Due to the critical neurovascular structures traversing the ITF, this space should always be entered bluntly with the utmost surgical precision and care.

There are a few limitations to the widespread utilization of the technology for this purpose. Registration errors and inaccuracy are very small with the current technology, accurate to within a few millimeters. Registration is flexible and may be centered to focus on the desired location, making risks of injuring the surrounding neurovascular structures minimal. Surgeons instrumenting the deep neck spaces should also consider magnetic resonance imaging-guided technology, when available, to better delineate critical neurovasculature. Cost is certainly worth noting, although once the technology is purchased, the individual cost per use is limited. Since many centers have already implemented CT-guided technology for use in endoscopic sinus surgery, the availability of the hardware should prompt an expansion in its indications. While indications for this approach should be dictated by the surgeon's experience and expertise, DNSIs which often require only cannulation and blunt dissection rather than surgical excision are most appropriate for "blind" image-guided dissection. Surgeons should approach ITF pathology, such as tumors that require excision, through an extended transnasal transpterygoid endoscopic approach or through an open approach as classified by Fisch. There has been one other report of using a CT-guided imaging system intraoperatively for the treatment of a pterygomandibular abscess after a failed surgical drainage attempt using an intraoral approach in 2018 (10). However, numerous examples of CT are being used in the head and neck region for abscess diagnosis and drainage.

Conclusion

In patients requiring re-operation for recurrent or difficult-to-treat abscesses, the surgeon should consider image-guided technology as a potential adjunct for intraoperative localization. CT-guided imaging can assist in localizing and protecting vital anatomical structures during deep neck abscess drainage.

Informed Consent: Informed consent was obtained.

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Authorship Contributions

Surgical and Medical Practices: M.J.U., S.Al-K., Concept: A.M., M.J.U., S.Al-K., Design: A.M., M.J.U., S.Al-K., Data Collection and/or Processing: A.M., M.J.U., Analysis and/or Interpretation: A.M., M.J.U., Literature Search: A.M., M.J.U., Writing: A.M., M.J.U.

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Main Points

- Infratemporal abscess is a difficult localization for drainage.
- Computed tomography (CT)-guided surgery is a recent innovative tool for infratemporal fossa abscess drainage.
- The primary objective of this work is to report on the minimally invasive approach and review the role of image-guided surgery in the management of deep neck space infections.
- We explore the presentation and unique CT-guided surgical management of an infratemporal fossa abscess in a 48-year-old male.
- Intraoperative CT-guided imaging can assist in localizing and protecting vital anatomical structures during deep neck abscess drainage.

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