

Radiology in Focus

Intra-operative ultrasound-guided drainage of parotid abscess

SCOTT M. GRAHAM, F.R.A.C.S., HENRY T. HOFFMAN, M.D., TIMOTHY M. McCULLOCH, M.D., GERRY F. FUNK, M.D.

Abstract

Parotitis complicated by parotid abscess remains a potentially life-threatening problem. Conventional surgical treatment involves incising the parotid parenchyma in the direction of the facial nerve until the abscess is located and evacuated. Intra-operative ultrasound greatly assists in localizing the abscess and in ensuring its complete drainage. Expedient and exact localization of the abscess reduces operative time. Equally importantly, ultrasound-assisted drainage reduces surgical dissection and the potential for facial nerve damage.

Key words: Abscess; Parotid gland; Drainage; Ultrasonography

Introduction

Parotitis complicated by parotid abscess is an uncommon condition. Parotitis may result from specific viraemia, as in the case of mumps, or, more usually in adults, from retrograde infection. Retrograde infection from the oral cavity is often a consequence of decreased salivary flow. In the past, this classically occurred in a dehydrated post-operative patient, sometimes as a preterminal event. Today, reduced salivary flow is more likely to result from dehydration from diuretics or the anticholinergic side-effects of prescription medicine. The decreased salivary flow of anorexia or Sjögren's syndrome may also predispose to this condition. Partial or complete obstruction of the parotid drainage system by calculi can cause stasis of saliva with progression to abscess formation. Bacterial parotitis is most often caused by *Staphylococcus aureus*. Streptococcal species and *Haemophilus influenzae* may play a role in community-acquired disease (Kane and McCaffrey, 1993).

The key intervention in management of most cases of parotitis complicated by abscess formation is surgical drainage. Surgery is appropriately directed to evacuate the abscess and preserve facial nerve function. Magnetic resonance imaging (MRI) or computed tomography (CT) is routinely employed for pre-operative evaluation. In some cases, the abscess cavity may be readily identified by referring to these studies and palpating the gland. In more advanced cases, induration and swelling in the adjacent soft tissue may interfere with localization of the abscess.

The use of intra-operative imaging as an aid to surgery is still under development. Interactive, dynamic CT is used in some centres to improve surgical precision. In its present state, interactive CT adds complexity to operative preparation and is expensive. It has found its widest application in the field of head and neck surgery in paranasal sinus surgery (Fried *et al.*, 1997). Intra-operative

ultrasound has been used more extensively in neurosurgery as an aid in localizing cerebral tumours and abscesses, as well as spinal cord lesions. The use of ultrasound in otolaryngology has included its application in the imaging of suspected metastatic neck disease (Van den Brekel *et al.*, 1996). The utility of ultrasound in the parotid has received little contemporary attention. Ultrasound has been used to help in the differentiation between malignant and benign parotid tumours (Baker and Ossoinig, 1977) and to pre-operatively differentiate between simple parotitis and parotitis complicated by abscess (Magaram and Gooding, 1980). More recently, it has been used to localize cysts for fine needle aspiration (Bindou *et al.*, 1996). Ultrasound in modern-day parotid imaging has largely been supplanted by the widespread availability of CT and MRI. The following case demonstrates the value of ultrasound used intra-operatively to localize a parotid abscess. This diagnostic aid allowed prompt, accurate localization of the abscess cavity and its complete drainage with minimal dissection and little danger to the facial nerve.

Case report

A 64-year-old woman had experienced two weeks of intermittent right facial swelling which had become constant in nature and increased in size over a 10-day period. The swelling persisted, despite treatment with oral cephalixin, and this prompted referral to our institution. On presentation, an enlarged firm right parotid was identified, along with extensive facial swelling and marked trismus. There had been no history of dehydration and the patient was not taking diuretics or medication with anticholinergic side-effects. Treatment was instituted with intravenous nafcillin. An MRI scan identified a swollen right parotid gland, containing a complex cystic structure

From the Division of Head and Neck Surgery, Department of Otolaryngology–Head and Neck Surgery, University of Iowa College of Medicine, Iowa City, Iowa, USA.

Accepted for publication: 3 September 1998.



FIG. 1

Pre-operative coronal magnetic resonance imaging (MRI) scan, T₁-weighted image with contrast. The scan reveals normal submandibular glands and a normal left parotid gland. The right parotid gland is markedly swollen and contains a complex cystic structure (arrow) compatible with an abscess.

compatible with an abscess (Figure 1). Progress of the facial swelling, along with continued fever, despite 48 hours of intravenous nafcillin, indicated surgical intervention.

The patient was nasotracheally intubated with tracheostomy stand-by. A standard parotidectomy incision and flap elevation were performed. A high-resolution ultrasound

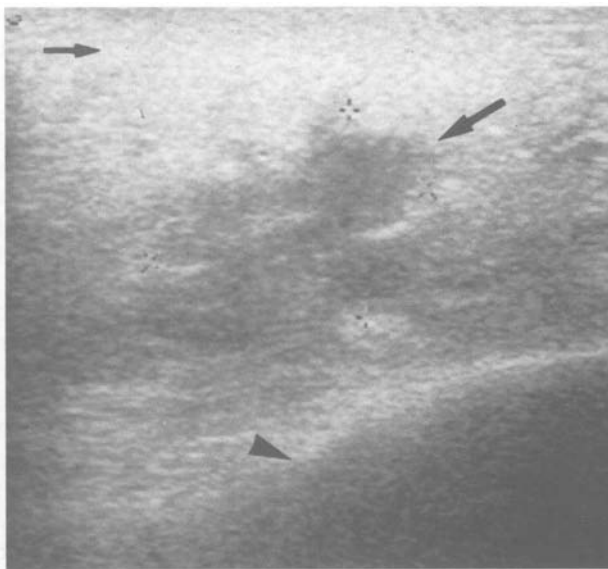


FIG. 2a

Intra-operative ultrasound image, revealing parotid parenchyma (smaller tailed arrow), abscess cavity (larger tailed arrow) and mandibular cortex (arrow, no tail).

machine had been brought to the operating room. A small footprint probe with a 7 mHz linear phased array transducer was sterilely wrapped and applied directly to the parotid surface. The ultrasound transducer was passed over the parotid from superior to inferior and from posterior to anterior. This resulted in identification of the single loculated abscess cavity (Figures 2a & b). Employing ultrasound localization, a small amount of inspissated pus was aspirated to confirm the location (Figure 3). A haemostat was then used to dissect along the needle into the abscess. Opening of this tract released 7 cc of thick pus. Further widening of the tract allowed digital exploration of the cavity with breakdown of the loculations. The cavity was irrigated. Repeat ultrasound examination revealed no remaining lesions. Two quarter-inch Penrose drains were placed in the cavity and the wound was loosely closed.

The parotid aspirate failed to reveal any organisms on Gram stain. The aspirate eventually grew *Peptostreptococcus* sp. and the patient completed a 14-day course of cephalexin. She recovered uneventfully with normal facial nerve function.

Discussion

Parotitis complicated by abscess formation is a potentially life-threatening illness. Septicaemia, trismus, deep neck space infection and infection of the carotid sheath, if not treated, will lead to the patient's demise (Gidley *et al.*, 1997). Conventional surgery for this condition involves a standard parotidectomy incision and flap elevation. Stab incisions are made in the parotid fascia and into the parotid substance parallel to the facial nerve until pus is found. This procedure is often bloody and, with sometimes extensive dissection, puts the facial nerve at risk. At the other end of the treatment spectrum, ultrasound-assisted percutaneous needle drainage of a parotid abscess has been proposed (Rice, 1993). This procedure could be combined with irrigation of the cavity after material has been removed for microbiological analysis. There may be a select group of patients with smaller abscesses and less swelling for whom ultrasound-assisted percutaneous needle drainage could be useful. As yet, however, the utility of

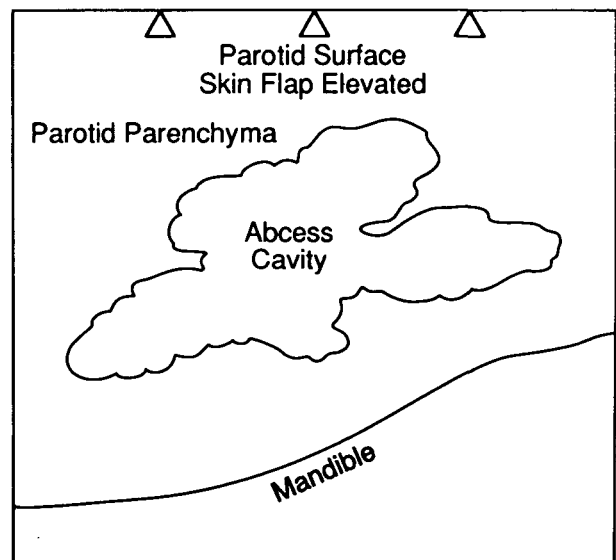


FIG. 2b

Line diagram, emphasizing the anatomical features in Figure 2a.



FIG. 3

Intra-operative application of sterilely-draped ultrasound transducer (arrow) to the exposed parotid surface with the skin flap retracted. The needle is in the abscess cavity. This is confirmed on ultrasound and by the presence of pus in the syringe.

this approach remains unproven. Because of the advanced nature of our patient's illness, a more definitive drainage appeared indicated.

Ultrasound-assisted open drainage of parotid abscesses offers advantages over the conventional surgical technique. The abscess can be localized quickly and exactly, reducing operative time and unnecessary dissection. Minimal dissection means less potential for damage to the facial nerve. In contrast to the percutaneous procedure proposed by Rice (1993), the open nature of this surgical technique allows proper digital exploration of the abscess cavity and post-operative placement of drains. When the abscess has been drained, the ultrasound probe can be reapplied to ensure that there are no unexplored loculations or further abscesses. Ultrasound-assisted open drainage of parotid abscesses is a useful new technique, utilizing widely available technology. Portable high-resolu-

tion ultrasound machines are now available in the radiology departments of most hospitals. Ultrasound-assisted open drainage of parotid abscesses can expedite recovery and reduce surgical risks from the treatment of this difficult and often severe condition.

References

- Baker, S., Ossoinig, K. D. (1977) Ultrasound evaluation of salivary glands. *Transactions of the American Academy of Ophthalmology and Otolaryngology* **84**: 750.
- Bindou, M., Brun, F., Leroux, E., Ney, D., Staub, T., Bourjat, P. (1996) MRI and CT of parotid diseases in HIV-positive patients. *Journal de Radiologie* **77(7)**: 483–487.
- Fried, M. P., Kleefield, J., Gopal, H., Reardon, E., Ho, B. T., Kuhn, F. A. (1997) Image-guided endoscopic surgery: results of accuracy and performance in a multicenter chemical study using an electromagnetic tracking system. *Laryngoscope* **107(5)**: 594–601.
- Gidley, P. W., Ghorayeb, B. Y., Stiernberg, C. M. (1997) Contemporary management of deep neck space infections. *Otolaryngology–Head and Neck Surgery* **116(1)**: 16–22.
- Kane, W. J., McCaffrey, T. V. (1993) Infections. In *Salivary Glands, Otolaryngology–Head and Neck Surgery* 2nd Edition. (Cummings, C. W., ed.), Mosby, St Louis, pp 1008–1017.
- Magaram, D., Gooding, G. A. W. (1980) Ultrasonic-guided aspiration of parotid abscess. *Archives of Otolaryngology* **107**: 549.
- Rice, D. H. (1993) Diagnostic imaging. In *Salivary Glands, Otolaryngology–Head and Neck Surgery* 2nd Edition, (Cummings, C. W., ed.), Mosby, St Louis, pp 997–1007.
- Van den Brekel, M. W., Castelijns, J. A., Snow, G. B. (1996) Imaging of cervical lymphadenopathy. *Neuroimaging Clinics of North America* **6(2)**: 417–434.

Address for correspondence:
 Scott M. Graham, F.R.A.C.S.,
 University of Iowa Hospitals and Clinics,
 Department of Otolaryngology–Head and Neck Surgery,
 200 Hawkins Drive, E230 GH,
 Iowa City, Iowa 52242, USA.

Fax: (319) 356-4547