Fatal deep neck infection and respiratory arrest

Michael H. Lee, DMD^{a,b} , Ryan A. Carmichael, DDS, MD^a , Andrew M. Read-Fuller, DDS, MD^a and Likith V. Reddy, DDS, MD^a

^aDepartment of Oral and Maxillofacial Surgery, Baylor University Medical Center and Texas A&M College of Dentistry, Dallas, Texas; ^bDental Corps, United States Navy

ABSTRACT

Despite the wide availability of antibiotics and medical care, deep neck infections requiring hospitalization are associated with significant morbidity and mortality. Thus, early recognition and aggressive treatment are key in preventing unfavorable outcomes. We present the case of a patient who rapidly progressed from nonspecific upper respiratory symptoms to obstructive airway loss and death due to a swiftly worsening deep neck infection.

KEYWORDS Deep neck infection; Ludwig's angina; submandibular space

Deep neck infections (DNIs) have decreased in frequency, severity, and mortality rate since the widespread introduction of antibiotics throughout the world but are still treated by oral and maxillofacial surgeons on a regular basis.^{1–4} In 38% to 49% of cases, these infections progress as sequelae of odontogenic infections, and up to 31% of infections may stem from infections of the tonsils and peritonsillar tissue.^{5,6} Classically, the most dangerous complications of DNIs are reported to be airway obstruction and descending mediastinitis, although modern mortality from these entities is rare.^{1,4,5} Rapid recognition and prompt treatment are key to avoiding negative outcomes in these patients.^{1,2,4}

CASE PRESENTATION

A 72-year-old woman with known type 2 diabetes mellitus, rheumatoid arthritis, and hypothyroidism presented to a local hospital emergency room via ambulance due to upper respiratory symptoms for the previous 2 days. She was forced to pull over on the way to the hospital due to increasing respiratory distress and called 911. When emergency rescuers arrived, she was in respiratory arrest with pulseless electrical activity. Cardiopulmonary resuscitation was initiated for an

unspecified duration, and return of spontaneous circulation was achieved after one dose of epinephrine. Intubation was unsuccessful, and a bag-valve mask was used to ventilate the patient. Upon arrival to the emergency room, multiple attempts were required for intubation. A computed tomography (CT) scan of the neck without contrast was taken and suggested dental disease as a potential source of infection. The patient was transferred to our facility that evening for a higher level of care.

On examination, the patient was afebrile, tachycardic (110–120 beats per minute), and tachypneic on ventilator support, with a Glasgow Coma Scale score of 3. Mild to moderate submandibular and neck edema was noted, greater on the left than on the right. Her oral examination revealed no apparent odontogenic source for the presumed abscess. Her white blood cell count was $33.0 \times 10^9/L$ with 18% bands, lactic acid was 2.7 mmol/L, and procalcitonin was 6.77 ng/mL, consistent with severe sepsis. Her existing antibiotic regimen of vancomycin, cefepime, and metronidazole was continued. An electroencephalogram yielded results consistent with a severe encephalopathy. A contrast-enhanced CT scan revealed an enlarged left tonsil, as well as a 10-cm fluid collection (*Figure 1*) extending from the tonsil inferiorly

Corresponding author: Michael H. Lee, DMD, Department of Oral and Maxillofacial Surgery, Texas A&M College of Dentistry, 3302 Gaston Avenue, Dallas, TX 75246 (e-mail: Mike.lee.dmd@gmail.com)

Dr. Carmichael is now in private practice in Arlington, Texas.

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Figure 1. Contrast-enhanced CT of the soft tissue in the neck obtained on hospital day 1. Arrows denote the superior and inferior limits of the fluid collection. Note the absence of any normal upper airway around the endotracheal tube.

to the level of the thyroid in the bilateral parapharyngeal and retropharyngeal spaces.

The patient was taken to the operating room on day 4 for incision and drainage of these abscesses through both intraoral and extraoral routes, at which time a tear in the mucosa adjacent to the left palatine tonsil was visualized. Significant purulent exudate was obtained. Due to lack of clinical improvement, a repeat contrast-enhanced CT was obtained the next day and indicated significant residual fluid collection. Additional surgical drainage was performed on day 6; however, no improvement was noted and her white blood cell count remained over $30 \times 10^9/L$. Pressor support was initiated on day 6 due to progressive hemodynamic instability. The hospitalist team obtained magnetic resonance imaging of the brain, which revealed global anoxic brain injury, and the patient's family elected to withdraw care. The patient died on day 9.

DISCUSSION

Initial airway management is critical in patients who present with a threat of imminent airway compromise.^{2,7,8} Field intubation may be unsuccessful due to distorted airway anatomy in these patients, and alternatives must be available for patients who cannot be ventilated with the bag-valve mask.⁹ A quarter of intubations in the prehospital setting may be unrecognized failures.⁷ In the hospital setting, the use of awake tracheotomy under local anesthesia carries risks, including delay in securing the airway, bleeding, additional swelling, and iatrogenic damage.^{3,8} Ovassapian et al reported

that out of 26 DNIs, 25 were successfully intubated using an awake fiberoptic intubation technique.¹⁰ Wolfe et al reviewed 19 cases of emergent DNI patients treated with advanced airway techniques and found that none of the patients required emergent tracheotomy.¹¹ The use of awake fiberoptic intubation for initial management may facilitate successful tracheotomy under more controlled conditions.⁸

DNIs may arise from multiple sources.⁴ In our case, though the infection was initially suspected to be odontogenic, imaging suggested a peritonsillar or pharyngeal origin. Boscolo-Rizzo et al reviewed 365 cases and found that 32.6% were pharyngeal in origin, 27.9% odontogenic, 10.7% submandibular sialadenitis, and 6.3% parotitis. In 18.9% of patients, there was no identifiable source.⁵ In contrast, Marioni et al reviewed 233 cases and found that 39.5% were odontogenic, 16.3% were of pharyngo-tonsillar origin, 13.7% were due to sialadenitis, and 18.9% were from an unknown source.⁶ The most common odontogenic sources are dental caries, pericoronitis, and periodontitis.¹²

Although our patient had diabetes mellitus type 2, her hemoglobin A1C of 5.7% indicated excellent glycemic control.¹³ However, diabetes is significantly associated with increased severity of infections and mortality.^{1,14} Topazian listed multiple factors contributing to severe DNIs, including diabetes, splenectomy, alcohol abuse, hepatitis, renal disease, drug abuse, steroid use, malnutrition, and immunocompromised states.¹ Diabetes is associated with a greater incidence of abscess formation, longer hospital stays, and greater rates of complication and airway intervention.¹⁵

Overall mortality from DNIs has decreased since the widespread introduction of antibiotics.^{1,3} Boscolo-Rizzo et al listed diabetes, surgically confirmed abscess, and multispace involvement as predictors of life-threatening complications, mostly presenting as acute airway obstruction or mediastinitis. However, their reported mortality rate remained low at 0.27%.⁵ Notably, 62% of their patients responded to antibiotics alone, whereas Marioni et al reported that 66.5% of their patients required drainage.⁶ Other studies have reported mortality rates of 8.4% to 9.3%.^{16,17} Involvement of the parapharyngeal and retropharyngeal spaces correlates with increased severity and complications.¹⁶

Upon transfer of this patient to our facility, the only imaging study available was CT without contrast, which delayed a thorough assessment. Contrast-enhanced CT is a vital adjunct in patients with DNI, facilitating identification of abscess and fluid collection within the parapharyngeal spaces.⁴ Smith et al found that contrast-enhanced CT had a 75% positive predictive value in identifying abscess later confirmed surgically and additionally found that the presence of scalloped margins around the rim of the fluid collections increased this positive predictive value to 94%.¹⁸ Contrast-enhanced CT should be considered highly sensitive for detecting DNIs¹⁹ and plays a critical role in the assessment of these patients.⁸

ORCID

Michael H. Lee <http://orcid.org/0000-0003-1341-546X>

Ryan A. Carmichael <http://orcid.org/0000-0002-6942-5897>

Andrew M. Read-Fuller <http://orcid.org/0000-0001-8443-0873>

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