

Case Report

Extensive deep neck infection associated with acupuncture

Maryam Hassanesfahani^{1*}, Jane Tian¹, Kelly L. Cervellione², Martine A. Louis¹

¹Flushing Hospital Medical Centre, Department of Surgery, Flushing, New York

²Department of Clinical Research, MediSys Health Network, Jamaica, New York

Received: 18 June 2024

Revised: 10 July 2024

Accepted: 16 July 2024

*Correspondence:

Dr. Maryam Hassanesfahani,

E-mail: maryam.h.esfahani82@gmail.com

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ABSTRACT

Deep neck infections are rare but potentially lethal conditions that require prompt identification and management. They can occur in the peritonsillar, submandibular, parapharyngeal and retropharyngeal spaces. The most affected areas tend to differ by age, with tonsillitis being more common in children and odontogenic in older adults. Predisposing factors to infection can also influence location. Early treatment is paramount as airway compromise, septic shock and extension to adjacent structures can lead to morbidity and mortality. Here we report a case of extensive deep neck infection in an elderly diabetic patient with multiple abscesses involving the paraspinal space and extending anteriorly close to the carotid sheath, yet without airway compromise or hemodynamic instability. After further questioning, the likely mode of infection was identified as acupuncture in the affected region. We present a review of the presentations, differential diagnoses, treatments, and clinical course of adults with deep neck infections to highlight the importance of expeditious diagnosis and treatment.

Keywords: Acupuncture, Debridement, Deep neck infection, Negative wound pressure, Interventional radiology drainage

INTRODUCTION

Deep neck infection (DNI) is a rare condition, especially in adults. It can occur in the peritonsillar, submandibular, parapharyngeal and/or retropharyngeal spaces between the layers of the cervical fascia, with the most affected areas differing by age group. In children, tonsillitis is typically the initial insult; in adults, an odontogenic infection is often seen.¹ Comorbid conditions like diabetes or HIV and socio-behavioral factors like dental hygiene and IV drug use influence the risk for and location of DNI.²⁻⁴ An understanding of neck anatomy, microbiology, and clinical presentations of DNI can facilitate prompt diagnosis to prevent rapid, potentially fatal complications such as airway compromise, septic shock, and extension to adjacent structures like the carotid sheath and the mediastinum.^{5,6} We present the case of a 69-year-old diabetic male with an extensive soft

tissue infection involving multiple neck spaces and partially the face, interestingly without airway compromise, or hemodynamic instability, which was managed with antibiotics and surgery. The only identifiable mode of infectious transmission was acupuncture in the affected location.

CASE REPORT

A 69-year-old male with diabetes mellitus and hypertension presented with significant swelling of the posterior neck extending anteriorly to the face, making it difficult for him to open his eyes. This was associated with a painful draining wound, limited range of motion in the neck and dysphagia for the prior 10 days. The patient reported receiving acupuncture multiple times, the last time several days prior to admission. On admission he was afebrile with stable vital signs. Physical exam

demonstrated a wound on the posterior side of the neck measuring 7.5×10 cm with fibrinous debris and purulent drainage surrounded by extensive erythema (Figure 1). Initial labs were significant for white blood cells of 48.8 (reference range 3.8 - 11.0 K/uL), hemoglobin of 7.7 (13.517.5 g/dl), blood glucose of 388 (74-110 mg/dl), sodium of 129 (137-145), lactate of 1.77 (0.7-2), and albumin of 3.1 (3.5-5). Hemoglobin A1c was 12.2.



Figure 1: Wound on presentation and post-operative.

On imaging, a neck CT showed posterior soft tissue swelling involving the subcutaneous fat and perivertebral muscles, with multiple, poorly defined fluid collection. The inflammatory process was mostly contained within the deep layer of the deep cervical fascia (Figure 2). Zosyn and vancomycin were started, and the patient underwent incision and drainage with extensive debridement of the posterior neck. The patient was admitted to the SICU for 4 days. Fluid cultures grew methicillin-resistant *Staphylococcus aureus*. Zosyn was switched to ampicillin-sulbactam and vancomycin was continued.



Figure 2: CT head and neck on admission.

The swelling of the face decreased gradually within the next 3 days. The patient underwent two additional debridement's with washout and drainage on admissions days two and six. Negative pressure wound therapy

(wound vac) was initiated on day 10 which resulted in significant improvement of the wound healing. The patient was discharged to a skilled nursing facility on day 15. Negative wound therapy was discontinued in the nursing facility a few days later. The patient received a total of 30 days of antibiotics and was seen doing well in outpatient clinic 3 weeks after discharge, with a near healed wound.

DISCUSSION

Presentation and risk factors

Deep neck space infections have variable presentations depending on the affected location, the etiology, and patient characteristics, such as age, medical history, and socio-behavioral factors. The primary presentation depends on the location of the infection. Odontogenic infections usually invade peritonsillar and submandibular spaces, presenting asodynophagia and/or sore throat followed by trismus, neck swelling, and fever.⁷ The spectrum of the severity can span from simple cellulitis to abscess or necrotizing fasciitis.⁸ Iatrogenic circumstances have also been linked to DNI involving indwelling instruments such as endotracheal tube or TEE.^{9,10} Possibly due to compromising neurovascular structures, DNI can rarely lead to stroke or quadriplegia, which was an initial concern during management of our patient.¹¹ DNI can also be the initial presentation of HS and can be associated with dysphagia or mass effect affecting other structures. This comes with an increased risk of recurrence raising the potential for long-term antibiotics to keep the disease in remission.^{12,13} Diabetes and hypertension are the most reported comorbidities in DNI with a prevalence of 45% and 23% respectively; these can significantly impact outcomes.^{7,8,14,15} One case series found psychiatric disorders and dementia to be frequent comorbidities in patients with DNI.¹⁶ HIV is a significant risk factor DNI.² Other susceptible populations include patients with end stage renal disease (ESRD), rheumatoid arthritis (RA), cirrhosis, Crohn's disease, and tuberculosis (TB).¹⁶⁻²² Systemic lupus erythematosus may increase the risk of DNI by up to five times.²³ Socio-behavioral risk factors for DNI include poor dental hygiene and intravenous drug use.^{3,4} More rarely DNI has been associated with contaminated prednisolone injection, radiation, acupuncture, herbal medication application, and COVID pneumonia.²⁴⁻²⁸ Our patient was a non-compliant diabetic patient with a hemoglobin A1C of 12.2, a significant risk factor for DNI. In addition, upon detailed questioning, the patient reported recent acupuncture treatment in the neck.

Differential diagnosis

Differential diagnosis of DNI can include a spectrum of disease states, including infected giant carbuncle, malignancy, TB giant lymphadenitis, hidradenitis suppurativa (HS), vascular malformations or pseudoaneurysm, paraspinal abscess, and cervical

epidural abscess. A careful physical exam and detailed review of history are of utmost importance during the diagnostic process. DNI is most common at the two ends of the age spectrum, in infants and in the elderly; there is a male predominance (55.5% to 88.7%).^{14,15} The most prevalent etiologies are bacterial tonsillitis (31.7- 42.6%), more common in children, and odontogenic infections (23.7%), more common in older adults. Other possible etiologies include tonsillo-pharyngitis, infected lymphadenopathy, trauma, thyroglossal duct cyst, salivary gland infections, foreign body, and complicated otitis media.^{14,15} Furunculosis has also been reported as the primary etiology with an incidence of about 7%.²⁹ Recurrent sepsis and persistent organ dysfunction are leading causes of long-term mortality, especially in older adults and those with significant comorbidities. Peritonsillar space followed by submandibular space are the most prevalent sites (30-37%). In adults, DNI usually involves multiple spaces simultaneously. Even though our patient had an extensive infection for over a week and risk factors for morbidity, he had no organ dysfunction and an uncomplicated disease course. CT scan is the most useful imaging modality to confirm the diagnosis of DNI, evaluate the extent of the disease, rule out other differential diagnosis, identify possible complications, and facilitate treatment choice: medical versus surgical or radiological interventional.^{15,29,30} Both ultrasound and MRI can provide complementary information in the setting of DNI.³¹

Clinical Course and Management

Several factors likely influence disease course and outcomes. Age has been shown to be significantly correlated with LOS, whereas location of infection is not in a study considering nutritional status and the impact on disease course in patients with DNI, body mass index (BMI) and C-reactive protein (CRP) were not associated with outcome, however serum albumin less than 3.0 g/dl was an independent predictor of disease severity, possibility of complications and outcome.³³ Additional studies have revealed an association between risk of complications from DNI and diabetes mellitus, iron deficiency anemia, multiple space involvement, and chronic obstructive pulmonary disease (COPD).³⁰ Our patient had a hemoglobin of 7.7, glucose on admission of 388, sodium of 129, WBC of 48, and Hemoglobin A1C of 12.2, with extensive involvement of multiple neck spaces. Albumin was initially 3.1, which could be due to hemoconcentration, and was 1.9 on day 2. Though albumin less than 3 could be an independent risk factor for developing complications and increase the severity of the disease, our patient had a good outcome. DNI is usually polymicrobial. *Streptococcus pyogenes* is the most common microorganism (23.3-53%), followed by methicillin-susceptible *Staphylococcus aureus* (12-21.3%) and methicillin-resistant *Staphylococcus aureus* (MRSA) (12%).¹⁴ A negative culture can be seen in up to a quarter of patients.¹⁵ The most common anaerobic bacteria are *Peptostreptococcus* species followed by

Prevotella species with prevalence of 28 and 8% respectively.^{15,34} In our patients, cultures grew MRSA. Initial antibiotics of choice for suspected DNI are amoxicillin-clavulanate and metronidazole or clindamycin. However, antibiotic therapy should be adjusted accordingly based on the results of the cultures.^{7,14,34} When an abscess is present, it should be drained appropriately. Both image-guided drainage and surgical drainage have been investigated. Patients with well-circumscribed unilocular collections who undergo ultrasound-guided drainage followed by serially guided drainage with or without placement of a drain have similar outcomes as those who undergo surgical intervention.⁵ Hospital length of stay is shorter for patients who undergo ultrasound-guided treatment versus those who are managed surgically.³¹ Injury to adjacent neurogenic structures can occur during surgical drainage with subsequent neurologic deficit due to the proximity of the spinal cord.³⁵ Our patient had 3 surgical drainage procedures with debridement in the operating room within the first week of admission and was discharged on day 15 with no complications. The number of infected spaces is the most important predictive factor of failure after nonsurgical management.³⁶ Many articles have shown that adjunctive, short-term, high dose steroid therapy can reduce pain, trismus, edema, and odynophagia in addition to shorten recovery time in adults.^{37,38} The role of vacuum therapy (wound VAC), which employs negative pressure dressing over the incision site, has been investigated. Vacuum therapy is cost effective and may decrease hospital stay duration, recovery time, pain, and nursing workload.³⁹⁻⁴¹ A VAC was used for our patient for only one week and likely contributed to his nearly complete healing of his large neck wound within 3 weeks after his discharge. Necrotizing fasciitis and consequently sepsis are potentially fatal complications of DNI.

The risk of developing these complications increases in elderly diabetic patients with a higher CRP. Therefore, any evidence of sepsis should prompt more aggressive antibiotic therapy and possibly earlier interventions.⁴² Descending mediastinitis is an uncommon but serious complication of DNI. neutrophil to lymphocyte ratio ≥ 13 , age more than 55, and CRP ≥ 30 mg/dl have been reported as predictive factors for development of descending mediastinitis.⁴³ Pseudoaneurysms involving the carotid or vertebral artery are rare but potentially fatal complications as well. Appropriate imaging studies should precede any attempt at drainage to evaluate adjacent vascular structures and rule out the possibility of any pseudoaneurysm.⁴⁴⁻⁴⁶ Ludwig's angina is another well-known complication of DNI that could result in a fatal outcome. It is an extension of submandibular space infection usually originated from odontogenic infection/abscess. It can cause severe airway edema and obstruction, potentially producing respiratory difficulties, requiring the need for a secure airway and treatment to reduce edema. It is important to review imaging studies including neck CT to fully assess the extent of the

infectious process prior to any examination under anesthesia. Maintaining airway safety is a priority as it can potentially be compromised by edema, limited neck mobility of the neck or mouth opening.⁴⁷

CONCLUSION

DNI is a rare condition with an extensive list of differential diagnoses. Due to its potentially lethal complications with treatment delays, prompt diagnosis and management is needed. Optimal management involves understanding of the anatomy, identification of risk factors, meticulous physical examination, and close review of radiologic images with expert radiologists at initial encounters. Broad spectrum antibiotics and determination of best drainage approach should be done as early as possible while keeping patients in a monitored setting. Repeat imaging may be helpful when assessing treatment response and possible need to repeat drainage. Recent studies showed high rates of success with negative pressure wound management in conjunction with open surgical intervention. Though the patient we present had risk factors for complicated course and presented with extensive disease, he was successfully treated and discharged in 15 days without short-term complications.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Hassanesfahani M, Tian J, Cervellione KL, Louis MA. Extensive deep neck infection associated with acupuncture. *Int Surg J* 2024;11:1338-42.