

Case Report

Sepsis Due to Deep Posterior Neck Abscesses Secondary to *Prevotella bivia*: Beware of Emerging Opportunistic Pathogens

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Introduction

Hidradenitis Suppurativa (HS), also known as acne inversa, is a chronic inflammatory skin disorder usually associated with apocrine glands characterized by recurrent painful inflammatory nodules, pustules, abscesses, and scars [1]. It is believed to result from occlusion of the terminal hair follicles due to hyperkeratosis. Subsequent follicular rupture with secondary infection leads to persistent inflammation and a granulomatous reaction with resulting chronic sinus tracts with scarring. Eccrine gland ducts empty directly onto the skin surface whereas apocrine glands empty into the follicular canal. It therefore follows that plugging by hyperkeratosis would have more dire consequences in the apocrine glands [2].

Typically, it develops in intertriginous areas, such as the axilla, inguinal, anogenital, inframammary regions, and less commonly the nape of the neck [1-3]. Predisposing factors include obesity, diabetes mellitus and cigarette smoking. The predominant microorganisms isolated from patients with HS are usually gram-positive cocci, with the staphylococcus species being the most common [4]. However, few reports of *Prevotella bivia* isolated from abscesses involving the posterior neck have been described [4,5].

Prevotella species, once part of the *Bacteriodes* genus, are small anaerobic gram-negative rods frequently identified in different regions

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of the head and neck when the microbiome of the region is elucidated using deep sequencing techniques [6]. The species of *Prevotella* most often associated with causing diseases in humans are *P. intermedia*, *P. bivia*, *P. melaninogea (nica)*, *P. nigrescens* and *P. disiens* [7,8]. *P. bivia*, is usually found in vaginal and oral flora. *Prevotella* species have also been implicated in chronic sinusitis, middle ear infections, brain abscesses and intra abdominal abscesses [9].

There are multiple scoring systems used to evaluate and stage HS. The most common and practical is the Hurley classification, which consists of three stages:

Stage I: Single or multiple isolate abscess without any scarring or sinus tracts

Stage II: Recurrent single abscess or multiple widely separated lesions with formation of sinus tracts

Stage III: Diffuse and broad involvement across a regional area with multiple interconnected sinus tracts and abscess

Other scoring systems exist and include the Sartorius score, Physician Global Assessment (PGA) score and the Hidradenitis Suppurativa Severity Index (HSSI). These are more utilized in clinical studies and trials to provide more objective comparisons of management options (Ref).

The deep neck spaces are potential spaces separated by fascial planes. They include submandibular, masticator, parotid, parapharyngeal, retropharyngeal (danger), prevertebral and anterior visceral space. Deep neck abscesses are less frequent today possibly due to more timely administration of effective antibiotics. When poorly managed, they can lead to life-threatening complications. They most commonly arise secondary to dental, and sometimes oropharyngeal, infections. Less commonly, salivary gland infections may be causative.

HS involving the nape of the neck has not previously been associated with deep neck infections. Most infections are superficial and polymicrobial in nature with *Staphylococcus aureus* and *Streptococcus viridans* being the predominant gram-positive microorganisms. However, *Klebsiella pneumoniae* is more frequently isolated in diabetics particularly in Asia. Complications resulting from deep neck abscesses may be local such as mediastinitis, empyema, pericarditis, carotid artery rupture and jugular venous thrombosis. More distal or systemic involvement manifest as cavernous sinus thrombosis, septic emboli, and multisystem organ dysfunction. Typically, the infection involves one deep space adjacent to the index site, the submandibular and para-pharyngeal spaces being the most affected. However, multiple spaces may be involved from contiguous spread due to HS of the posterior neck, which can be extensive and requires surgical drainage and skin debridement [10,11]. Purulent effluent from the abscess typically yields microbiological cultures consistent with normal skin flora [11,12]. Similar to most HS lesions, deep neck infections are poly-microbial in nature [13]. The most frequently cultured bacteria from HS lesions are Gram-positive cocci and rods, such as coagulase negative *Staphylococci* and *Corynebacterium*, as well as various

subspecies of anaerobic bacteria [11,12]. Although they are uncommon, HS abscesses due to *Prevotella bivia* may be associated with a more aggressive form of deep infection and thereby lead to sepsis, which must be recognized early and effectively treated with a combination of surgical drainage and appropriate antibiotic coverage to prevent progression to septic shock, multiple organ dysfunction syndrome and death.

Case Report

The patient is a 21-year-old obese female with a known history of HS of the upper back, axilla, umbilicus, and groin. Eight days prior to presentation, she was seen at an outside facility for a flare up of a posterior neck abscess, which was treated with superficial incision and drainage. She was subsequently discharged home with topical clindamycin treatment. She presented to our emergency department with increasing pain in her posterior neck.

Physical examination was significant for a 3 cm hyperpigmented nodule along the posterior aspect of her neck with multiple sinus tracts along the bilateral axilla, consistent with Hurley Stage III disease. On admission, she had a leukocytosis of 13.9 K/mL. Computed Tomography (CT) of the neck revealed a rim enhancing fluid collection, measuring 3.9 x 2.4 cm, involving the skin and subcutaneous tissues of the right prevertebral neck space, extending down to the trapezius muscle (Figure 1). Given the patient's history, presentation and imaging, the decision was made to proceed with incision and drainage and debridement of the involved area.

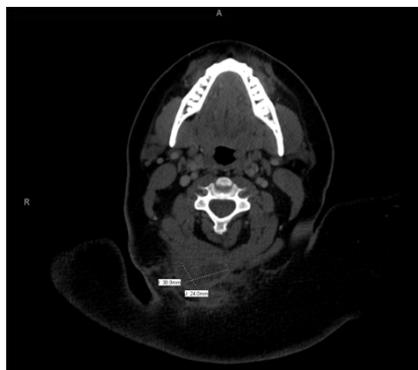


Figure 1: CT Scan Image of a Cervical Soft Tissue Infection with contrast demonstrating a 3.9 x 2.4 cm posterior neck deep space abscess.

An incision was made over the area of maximal fluctuance, and purulent fluid was evacuated from the abscess cavity and cultures were taken. All loculations were broken up and hair noted within the abscess cavity was removed. Attention was then turned to the posterior/superior back abscess, which was incised and drained, releasing approximately 100 mL of purulent fluid. A sample was also sent for culture and sensitivity and grew out *Prevotella*.

Her postoperative course was uneventful. She was subsequently discharged with twice daily gauze packing and started on a seven-day course of empiric oral clindamycin. Wound cultures revealed *P. bivia*. Because the minimal inhibitory concentration of antimicrobials to *P. bivia* are variable, interpretive criteria are not available from the Clinical and Laboratory Standards Institute, and sensitivities were not performed. At her 3-week follow-up, examination of her neck wound

revealed resolution of erythema and her HS, no drainage or fluctuance, and good granulation tissue.

Discussion

Changing trends in deep neck abscesses have been described in previous studies [13,14]. With improved recognition, hygiene and better antibiotic coverage, deep neck abscesses have been reported to occur less frequently than in the past [15,16]. Nevertheless, they remain challenging clinical emergencies. Once an abscess occupies one of the deep neck spaces, the infection can spread across the planes and/or damage adjacent vital neurovascular structures. Consequently, these types of infections can progress rapidly and become life-threatening medical conditions [15]. In addition to severe sepsis and septic shock, localized respiratory and digestive tract disturbance as well as more serious complications may occur, such as acute airway obstruction, pneumonia, lung abscess, mediastinitis, pericarditis, internal jugular vein thrombosis and carotid artery erosion [14-17]. Therefore, delayed recognition and management of deep neck infections and abscesses can result in catastrophic consequences and remains a challenge to surgeons and other physicians who treat this condition [11].

In our patient's case, Hidradenitis (HA) in the intertriginous areas of the posterior neck developed into a deep neck abscess. Abscess cultures from the HA-induced neck disease isolated *P. bivia* as the pathogen. Virulence mechanisms for *Prevotella* species include attachment to the mucosa, immune system evasion, and increased production of virulence factors as the microorganism transitions from commensal, in the oral flora, to opportunistic pathogen in the deep space [2,5]. Interestingly, one study demonstrated an increased level of proteolytic activity in pathologic *P. intermedia* clinical isolates versus those recovered from mouths of healthy subjects [7]. Another important virulence factor in *Prevotella* species infections is the Exopolysaccharide (EPS). EPS most commonly provides scaffolding for biofilm formation, a critical step in the development of dental caries and periodontal disease. In addition, EPS serves as a capsule that facilitates mucosal adherence and resistance to phagocytosis [18]. Although a direct role of EPS in the development of neck abscess has not been established, we hypothesize that the increased mucosal adherence contributes to the increased damage that *P. bivia* can cause to aero-digestive structures located in the neck. Although a multicenter study by Toprak et al., demonstrated *Prevotella* susceptibilities to piperacillin/tazobactam, carbapenems, tigecycline and metronidazole, it is essential to provide early coverage with an appropriate spectrum empiric antibiotic regimen until culture-directed antimicrobial therapy can be initiated given the potential for the aggressive spread of this pathogen.

Combined with adequate surgical drainage of the abscess, antibiotic therapy is essential for successful treatment [12,19-24]. For effective antimicrobial treatment, microbiologic data on the abscess are essential. However, it usually takes several days or longer to acquire the culture data. Therefore, empiric antimicrobial therapy is frequently initiated before definitive culture results are obtainable. Various empiric broad-spectrum antibiotic regimens have been used successfully in several studies [20-24]. However, due to increasing antibiotic resistance among these emerging pathogens it is important to be aware of the coverage efficacy of different empiric antibiotic regimens [12,20,21].

A retrospective study reviewed 89 culture positive hospitalized patients with deep neck abscesses diagnosed at a tertiary-care hospital over a 5-year period revealed that 89% (89/100) of bacterial cultures yielded positive results [25]. The predominant aerobes were viridans streptococci (37%), *Klebsiella pneumonia* (23%), and *Staphylococcus aureus* (11%). The predominant anaerobes included species of *Prevotella* (17%), *Peptostreptococcus* (14%) and *Bacteroides* (14%) [25]. Although the study determined that antimicrobial therapy should ideally be tailored to culture data, the coverage rate of different empiric antimicrobial agents was analyzed as well [25].

Multiple combinations of empiric antibiotics have been tested for the treatment of deep neck abscesses with similar efficacies; they are as follows [20,21,25]:

Regimen 1: Penicillin G, clindamycin and gentamicin

Regimen 2: Ceftriaxone and clindamycin

Regimen 3: Ceftriaxone and metronidazole

Regimen 4: Cefuroxime and clindamycin and

Regimen 5: Penicillin and metronidazole

The coverage rates of regimens 1, 2, 3, 4, and 5 were 67.4%, 76.4%, 70.8%, 61.8%, and 16.9%, respectively. Regimen 2 (ceftriaxone and clindamycin) demonstrated the most efficacious antibiotic treatment followed by regimen 3 (ceftriaxone and metronidazole). Regimen 2 was significantly better than regimen 4 (cefuroxime and clindamycin) ($p < 0.001$). Regimen 2 had better coverage than regimens 1 ($p = 0.096$) and 3 ($p = 0.302$), but the difference was not statistically significant [25].

Conclusion

HS of the posterior neck is a relatively uncommon cause of deep neck abscess. For effective treatment these cases typically require surgical drainage and complete debridement of the involved skin and soft tissues combined with appropriate antibiotic therapy. Fluid or tissue from the abscess should be sent for microbiological culture and sensitivity testing. Although common pathogens are typically consistent with skin flora *P. bivia* should be considered as a possible offending pathogen in HA-associated deep neck abscesses. For successful management, early recognition and treatment with proper empiric antibiotics and surgical drainage followed by culture-directed antibiotic therapy is necessary. We recommend using ceftriaxone and clindamycin for initial empiric antibiotic coverage until final culture data is obtained.

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