

Case Report

Presence of *Klebsiella Pneumoniae* on Black Hairy Tongue as Oral Microbiome Dysbiosis

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ABSTRACT

Introduction: Black hairy tongue (BHT) is a benign condition characterized by discoloration and elongation of filiform papillae. Although asymptomatic, it can trap microorganisms, potentially contributing to oral dysbiosis. The pathogenesis is still unclear, but smoking, drugs, alcohol, or excessive coffee/tea consumption trigger it. Diagnosis relies on history-taking, clinical assessment, and occasionally microscopic evaluation. This case report aims to show an interesting finding in the microbiological examination of black hairy tongue.

Case: A 33-year-old male smoker and coffee drinker presented with black tongue discoloration. Any medication use and a history of systemic diseases are denied, but he had a habit of smoking, staying up late, and heavy coffee consumption.

Case Management: Clinical assessment and microbiological swab analysis for bacterial and fungal identification were conducted. Microbiological examination revealed the presence of *Klebsiella pneumoniae*, a colonizing opportunistic pathogen.

Discussion: The patient reported no systemic diseases or medication use, with lifestyle factors identified as potential triggers. This case underscores the role of lifestyle factors and oral hygiene in the development of BHT and its association with microbial dysbiosis.

Conclusion: The detection of *K. pneumoniae* emphasizes the need for microbial evaluation in persistent cases to prevent potential systemic effects.

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INTRODUCTION

Black hairy tongue (BHT) is a condition that presents as a dark, furry tongue because of hypertrophic and elongated filiform lingual papillae.¹ First introduced by Amatus Lusitanus in 1557, it is usually known as *lingua villosa nigra*, *melanotrichia lingua*, *nigrites linguae*, and *keratomycosis linguae*. Generally, this condition is painless or asymptomatic, but may result in an aesthetic or appearance complaint.²

The occurrence rate of black hairy tongue varies, ranging from 0.6% to 13% in the population, and is significantly higher in males (3 times more than in females).^{2,3} Its etiopathophysiology is still not clear, but likely induced by lifestyle, such as inadequate oral hygiene, smoking, black tea, coffee, or alcohol consumption. Several medical conditions, for example, dry mouth, immunocompromised states, systemic infection, or some medications such as antibiotics and anti-xerostomia agents, put patients at higher risk of experiencing BHT. The deposition of bacteria, food particles, and other metabolic agents on the filiform papillae of the tongue results in this condition.² As microorganisms are often associated with black hairy tongue, this case highlights the unusual finding of detected bacteria on black hairy tongue.

CASE

A 33-year-old male presented with painless black discoloration of the tongue. He denied any medication use and a history of systemic diseases. He admitted having a smoking habit, one pack of conventional cigarettes a day. He is a night worker and sleeps less than 6 hours a day. He has a normal diet consisting of rice, protein, and vegetables, but rarely has fruit. He also has a habit of drinking a minimum of 2 cups of instant coffee a day.

The physical examination revealed a brownish-yellow to blackish discolored patch covering the tongue, accompanied by elongated, hair-like structures on the dorsal surface. The discoloration extended across nearly the entire dorsal surface and was surrounded by irregular white pseudomembranous patches. The middle posterior

region of the tongue exhibited a more pronounced hairy or furry appearance. (Figure 1).

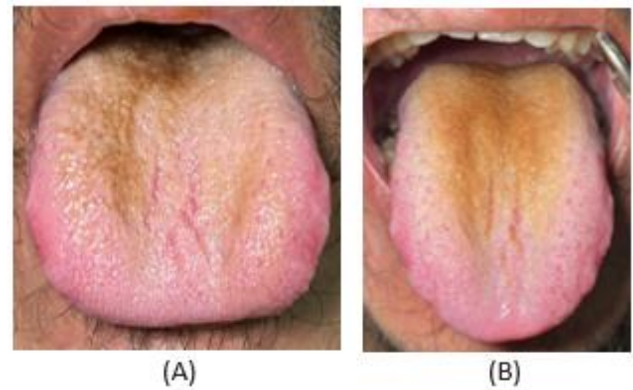


Figure 1. Patient's tongue on first visit (A) and on last visit (B).

CASE MANAGEMENT

The patient was then referred for bacteriological and mycological examination of the discolored tongue swab. He was given a prescription for 1% povidone-iodine solution to rinse with after brushing his teeth and cleaning his tongue.

The laboratory result reported positive culture of *Candida tropicalis*, *Candida glabrata*, *Streptococcus viridans*, and *Klebsiella pneumoniae*. Patient admitted to cleaning his tongue and using the prescribed mouthwash as instructed, but still couldn't change his habit. Oral examination showed that the tongue discoloration still persists, without any symptoms present.

DISCUSSION

Black hairy tongue is a clinical condition characterized by discoloration and elongation of the filiform papillae on the dorsal surface of the tongue. It is more prevalent in men and is often associated with systemic conditions, medication use, and specific lifestyle factors.³ In this case, subjective examination suggests that the underlying predisposing factors are lifestyle-related.

The precise pathophysiology of black hairy tongue remains unclear. Current hypotheses propose that the condition arises from defective desquamation of the dorsal surface of the tongue, impairing the physiological debridement, and leading to keratinized layer accumulation. This keratin deposition results in the elongation of filiform papillae, which can grow from their

normal length of less than 1 mm to 12–18 mm and up to 2 mm in width. These elongated papillae secondarily trap debris, fungi, and bacteria, contributing to discoloration and the characteristic "hairy" appearance.⁴

The term "black hairy tongue" is a misnomer, as the discoloration is not limited to black but may also manifest in brown, yellow, green, or blue hues. The color variation is typically due to trapped residues from tobacco, coffee, tea, other foods, or chromogenic organisms that produce pigments such as porphyrins.¹

Oral flora consists of a dynamic and complex community of microorganisms, including bacteria, fungi, viruses, archaea, and protozoa, that play a critical role in maintaining oral and systemic health by several mechanisms, such as the exclusion of harmful microbes and immune optimization.⁵ The dominant bacterial phyla in a healthy oral cavity are *Firmicutes*, *Bacteroidetes*, *Proteobacteria*, and *Actinobacteria*, which together make up 96% of total oral bacteria.³ Disruption of this balance, known as oral dysbiosis, can result from factors such as poor oral hygiene, diet, or medication use. Dysbiosis is linked to conditions like dental caries, oral cancer, and cardiovascular disease. Cigarette smoking significantly affects oral health by altering saliva composition, disrupting the oral microbiome, and compromising the immune response. Smoking can lower oxygen levels, increase saliva acidity, introduce toxins, exert antibiotic-like effects, affect bacterial adhesion to mucosal surfaces, and weaken the activity of immune cells, such as polymorphonuclear leukocytes. These changes promote oral dysbiosis, creating an environment conducive to the overgrowth of opportunistic pathogens.^{5,6}

In this case, *Klebsiella pneumoniae*, a Gram-negative rod bacterium, was identified on the tongue. Although it is typically found in the nasopharynx and feces of about 5% of healthy individuals, it is a known pathogen capable of causing pneumonia, bacteremia, wound infection, and meningitis.^{7,8} Additionally, subspecies like *K. pneumoniae ozaenae* and *K. pneumoniae rhinoscleromatis* can cause diseases such as ozena and rhinoscleroma, respectively. These conditions, although rare, illustrate the opportunistic potential of this bacterium.⁷

In the oral cavity, *Klebsiella pneumoniae* is classified as a colonizing opportunistic pathogen (COP), typically present in low numbers but capable of causing harm when the microbial balance is disrupted. However, significant shifts in microbiome composition, often due to poor oral hygiene or smoking, can enable *K. pneumoniae* to proliferate and become dominant, increasing the risk of infections, both community- as well as hospital-acquired pneumonia.^{3,7,9,10}

CONCLUSION

Black hairy tongue is a benign but visually striking condition that emphasizes the importance of maintaining oral hygiene and microbial balance. Lifestyle factors, particularly smoking, play a critical role in its development by disrupting the oral microbial ecology. Additionally, the identification of *Klebsiella pneumoniae* in such cases highlights the potential role of opportunistic pathogens in the progression of this condition. Addressing these factors is essential to prevent complications and ensure optimal oral health.

The presence of *Klebsiella pneumoniae* in black hairy tongue highlights the potential role of opportunistic pathogens in oral microbiome dysbiosis and its systemic implications. Further studies exploring the relationship between microbial composition, lifestyle factors, and black hairy tongue could provide insights into targeted preventive and therapeutic strategies.

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