

Case Series

String test as a diagnostic tool for hypervirulent *Klebsiella pneumoniae*

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Received: 24 November 2025

Accepted: 09 July 2026

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ABSTRACT

Klebsiella pneumoniae is an emerging pathogen capable of causing severe soft tissue infections including skin and wound infections, especially in immunocompromised individuals. The common organism causing soft tissue infection is gram positive bacteria, however *Klebsiella* is seen as an emerging virulent pathogen. These hypervirulent strains of *Klebsiella* can be detected easily by the “string test.” We present two diabetic elderly males with facial soft tissue infections which tested positive on the string test. They were successfully managed with surgical drainage, debridement, and intravenous antibiotics (ceftriaxone and metronidazole), tailored to sensitivity reports. This report highlights the value of the string test in early detection of the hypervirulent strain of *Klebsiella* guiding prompt, prolonged aggressive treatment to ensure complete disease clearance.

Keywords: *Klebsiella pneumoniae*, String test, Hypervirulent strains, Antibiotic sensitivity

INTRODUCTION

Klebsiella pneumoniae is a Gram-negative bacillus commonly implicated in healthcare-associated infections such as pneumonia, urinary tract infections and bloodstream infections.¹ In recent years, a hypervirulent variant (hvKP) has emerged, capable of causing severe community acquired infections including liver abscess, necrotizing fasciitis and meningitis often with metastatic spread.² A distinguishing feature of hvKP is its hypermucoviscosity, resulting from enhanced capsule production regulated by virulence genes such as *rmpA* and *rmpA2*.³

A simple laboratory screening method for this phenotype is the string test, where colonies stretched by a bacteriological loop form a viscous string >5 mm if positive. Though not specific, the string test is widely used in clinical laboratories to rapidly screen for hvKP, especially in resource-constrained settings.⁴ We report two cases of hvKP-associated soft tissue infections where the string test played a pivotal role in clinical suspicion and management.

CASE SERIES

Case 1

A 62-year-old male, known case of type 2 diabetes mellitus and hypertension, presented with a 2–3-day history of painful swelling of the upper lip, associated with fever. On examination, there were multiple pus pockets with necrosis of the upper lip. Initial management included incision and drainage, followed by wound debridement two days later. Pus culture revealed *Klebsiella pneumoniae*. The isolate tested positive on the string test, with a viscous string formation >5 mm.

Histopathological examination of debrided tissue revealed inflammatory ulceration with acute inflammation favoring an abscess. The patient was treated with intravenous antibiotics, adjusted according to sensitivity results. Blood glucose control was optimized.

The infection responded to treatment, with progressive healing of the soft tissue defect.

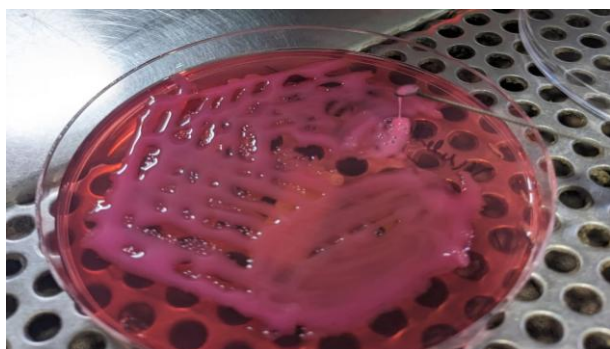


Figure 1: Case 1.

Case 2

A 70-year-old male with diabetes and hypertension presented with pain and swelling of the right buccal mucosa. On examination, two pus points were noted in the right gingivobuccal sulcus. Pus aspirated from the site yielded *Klebsiella pneumoniae* on culture. A positive string test confirmed hypermucoviscosity. Histopathological examination of debrided tissue revealed inflammatory ulceration with secondary subacute abscess formation. The patient was started on intravenous antibiotics, which were modified based on susceptibility testing. Wound care as maintained, and clinical recovery was achieved without complications.



Figure 2: Case 2.

DISCUSSION

These cases illustrate the clinical significance of hypervirulent *Klebsiella pneumoniae* in soft tissue infections, particularly among patients with diabetes mellitus—a known risk factor for invasive hvKP disease.^{1,5} Both patients presented with localized yet rapidly progressing infections of the oral and perioral regions. The string test served as a key screening tool in both instances. Although molecular testing remains the gold standard for identifying virulence genes, the string test offers a rapid, cost-effective alternative to flag potentially hypervirulent strains early in the diagnostic process.³ This is particularly

useful in centers without routine access to molecular diagnostics.

While the string test is not entirely specific, some non-hypervirulent strains may test positive, and some hvKP strains may be negative. Studies have shown strong correlation between positive string tests and the presence of virulence plasmids, especially when clinical features are suggestive of invasive disease. In both cases, prompt identification, guided by the string test and culture, allowed early initiation of IV antibiotics (Ceftazidime, Aztreonam), resulting in favorable outcomes without systemic spread. This supports incorporating the string test into standard diagnostic algorithms for *Klebsiella* infections with tissue involvement.

CONCLUSION

These two cases demonstrate the diagnostic and clinical utility of the string test in identifying hypermucoviscous *Klebsiella pneumoniae* strains. Given its simplicity and low cost, the test should be routinely performed in deep tissue infections caused by *K. pneumoniae*, particularly in patients with diabetes or other immunocompromising conditions. Early identification can help clinicians anticipate aggressive disease courses and optimize treatment promptly.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Ganesan S, Ray S. String test as a diagnostic tool for hypervirulent *Klebsiella pneumoniae*. *Int J Otorhinolaryngol Head Neck Surg* 2026;12:660-1.