A case of *Klebsiella pneumoniae* hypervirulent phenotype causing necrotizing fasciitis of chest wall: A mono-microbial entity emerging in the Indian subcontinent

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**Abstract**

Necrotizing fasciitis of the chest wall or upper torso is a rare clinical entity. Monomicrobial *Klebsiella pneumoniae* as a causative agent of necrotizing fasciitis is far less common than the polymicrobial etiology. Here, we report a case of community-onset pyogenic necrotizing fasciitis caused by *Klebsiella pneumoniae* in an immunocompetent male of tribal background from the rural area of Jharkhand, India. The hypermucoviscous phenotype of the bacterium causing necrotizing fasciitis has been infrequently reported from the Indian subcontinent to date. The existence of multidrug resistant trait in the hypervirulent pathotype poses a unique challenge in treatment in such a case and emerges as a critical community health problem requiring prompt attention of the public health stakeholders. Thus, there is a need for widespread awareness for proper protocols in antimicrobial usage, infection control, early diagnosis, and prompt treatment.

**Keywords:** hvKP, hypermucoviscous, hypervirulent, *Klebsiella pneumoniae*, KP-NF, necrotizing fasciitis

**Introduction**

Necrotizing fasciitis (NF) is the spreading inflammation of the skin, subcutaneous tissue, and deep fascia with extensive destruction of the tissues.[1] It is a potentially fatal condition with a mortality rate reported as high as 76% in the literature.[2] NF involving chest wall or upper torso is extremely uncommon.[3]

The success of management of the patient depends on early clinical suspicion, treatment with broad-spectrum antibiotics, and extensive debridement followed by delayed surgical reconstruction.[4]

Although polymicrobial infections are traditionally encountered as the etiology of NF, monomicrobial NF cases are on the rise. A significant proportion of these infections are caused by *Klebsiella pneumoniae*. The emergence of a highly virulent hypermucoviscous phenotype has further complicated the scenario with cases of *Klebsiella pneumoniae* - NF (KP-NF) caused by community-acquired strains reported from different parts of the world.[6,7]

**Case History**

A 50-year-old male patient belonging to the low socioeconomic status from the rural-tribal area of Jharkhand, India presented to...
the emergency department with fever and gangrenous wounds over the left side of the anterior chest wall and left axilla. His vitals were stable. He was admitted and broad-spectrum intravenous antibiotics were started viz. piperacillin-tazobactam, amikacin, and metronidazole.

As revealed from the history, the symptoms started with painful boils over the left side of the chest wall and axilla about 2.5 months back, which spontaneously ulcerated and gradually progressed in size and extent. It was associated with intermittent fever. He visited a local hospital where the wound was explored and some amount of debridement was done. After 3 weeks of treatment in the local hospital, there was no alleviation of the symptoms and he was referred to the tertiary care hospital of Rajendra Institute of Medical Sciences, Ranchi.

The patient was an alcoholic, smoker, and tobacco chewer for the past 10 years. There was no history of similar episodes, diabetes mellitus, tuberculosis, trauma or any surgical procedure, steroid intake, radiotherapy, or chemotherapeutic drug administration. He had no history of travel outside his domicile state in the recent past.

On local examination, a 10 × 20 cm ulcer was found at the left side of the anterior chest wall overlying the sternum and extending toward the left clavicle with gangrenous margins, necrotic slough at its base, and pus discharge. The nipple-areola complex was spared. Another ulcer of size 15 × 20 cm was present at the left axilla with similar features [Figure 1]. Findings of the systemic examination were unremarkable.

Routine investigations revealed normoglycemic status, hemoglobin 9.9 g/dl, total leukocyte count 10,200/mm³, lymphopenia (12.6%), and non-reactive serology for HIV, HBV, and HCV. Serum albumin level was below normal (2.6 g/dl), and blood urea nitrogen and creatinine levels were 31 mg/dl and 1.1 mg/dl, respectively.

Extensive debridement of the wound was carried out and necrotic material from deep inside the wounds was sent for culture and Ziehl–Neelsen staining for detection of acid-fast organisms. Multidrug-resistant *Klebsiella pneumoniae* as a monomicrobial entity with heavy growth was isolated on culture. The isolate was sensitive only to tigecycline, colistin, and polymyxin B, and a string test to detect hypermucoviscous phenotype was positive [Figure 2]. Blood culture was sterile. Results of other microbial investigations were negative.

Antibiotic coverage was changed to tigecycline and the regular antiseptic dressing was continued for about 3 weeks till the wounds were healthy with granulation tissue. He was discharged from the hospital and advised for regular follow-up. Elective delayed primary skin closure under local anesthesia was performed for the remaining wound area after 3 months.

**Discussion**

NF is a life-threatening condition occurring most commonly in immunocompromised, diabetic, and alcoholic patients. The most common site of involvement is the extremities, especially lower limbs, followed by abdomen, perineum, head, and neck, and chest. Necrotizing fasciitis of the chest wall is a rare clinical entity. Polymicrobial etiology comprising mainly coliforms and *Staphylococcus* are most commonly implicated in NF. When a single organism is responsible, the most common pathogen is Group A beta-hemolytic *Streptococcus*, that is, *Streptococcus pyogenes*. Multidrug-resistant (MDR) *Klebsiella pneumoniae* was isolated in the culture of the necrotic tissue from the wound in...
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the present case. KP-NF is an emerging life-threatening entity, predominantly encountered in patients with diabetes, chronic liver disease, and immunocompromised state. The majority of the KP-NF cases have been reported from Taiwan, where the hypervirulent Klebsiella pneumoniae (hvKP) have also emerged in the 1980s. In recent years, there are reports of hvKP causing NF involving limbs. The present article probably reports the first case of hvKP causing chest wall NF, which itself is also a rare clinical entity.

In contrast with classical Klebsiella pneumoniae (cKP) infections, which are more common in hospital settings in admitted patients, hvKP strains can colonize healthy individuals in the community leading to infections. The propensity of rapid metastatic spread to other organs such as eyes and lungs makes it a concern for primary care providers. Chronic alcohol consumption in our patient may likely have impaired the phagocytic activity of peripheral blood mononuclear cells against hvKP leading to infection by this microbe.

The most challenging step in the management of the case has been the choice of antimicrobials with very limited options depicted by the microorganism susceptibility testing. Until recently, hvKP, unlike cKP, has been reported susceptible to most of the available antibiotics. The confluence of antimicrobial resistance genes of cKP and the virulence determinants possessed by hvKP on the same or coexisting plasmids leading to the evolution of MDR and extensively drug-resistant (XDR) hvKP pathotypes has posed significant public health threat in the context of community-acquired infections. Early clinical suspicion by the primary healthcare provider and administration of appropriate antimicrobials with Gram-negative coverage considering the MDR trait may help to avoid fatality.

Acknowledgements

Required permission for publishing the case report has been obtained by the clinician involved in this case report.

We thank Dr. Rahul Garg (All India Institute of Medical Sciences, Bhopal, India) for his valuable inputs in the manuscript. We also thank Dr. Puja (Medall Diagnostic, RIMS, Ranchi) for her help in the laboratory investigations.

Key Messages

Chest wall necrotizing fasciitis is extremely rare and that caused by monomicrobial Klebsiella pneumoniae is even rarer. The hypervirulent pathotype of Klebsiella pneumoniae poses a challenge by causing community-acquired infections in immunocompetent residents and is on a rising trend. The emerging MDR and XDR hvKP infections leave us with limited therapeutic resources for the management of such cases.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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