Case Report

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

Rituparna Dasgupta[1], Arghya Das[2]

[1]Department of General Surgery, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, [2]Department of Microbiology, All India Institute of Medical Sciences, New Delhi, India

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 a rise. A significant proportion of these infections are caused by *Klebsiella pneumoniae*.[5] 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

Address for correspondence: Dr. Arghya Das, Department of Microbiology, All India Institute of Medical Sciences, New Delhi, India.
E-mail: arghyadas2401@gmail.com

Received: 30-05-2021 **Revised:** 11-10-2021
Accepted: 20-10-2021 **Published:** 31-01-2022

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_1023_21

How to cite this article: Dasgupta R, Das A. A case of *Klebsiella pneumoniae* hypervirulent phenotype causing necrotizing fasciitis of chest wall: A mono-microbial entity emerging in the Indian subcontinent. J Family Med Prim Care 2022;11:376-8.

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/mm^3, 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.[8] The most common site of involvement is the extremities, especially lower limbs, followed by abdomen, perineum, head, and neck, and chest.[9] Necrotizing fasciitis of the chest wall is a rare clinical entity.[3,10,11]

Symptoms and signs include pain, redness, blistering, presence of crepitation and foul-smelling discharge, gangrene, and toxemia often leading to systemic multi-organ failure. In the present case, the symptoms started with isolated boils over the left anterior chest wall and left axilla without any known inciting event.

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*.[4] Multidrug-resistant (MDR) *Klebsiella pneumoniae* was isolated in the culture of the necrotic tissue from the wound in

Figure 1: Wounds on the chest wall and left axilla (after extensive debridement) photographed during changing of antiseptic dressing

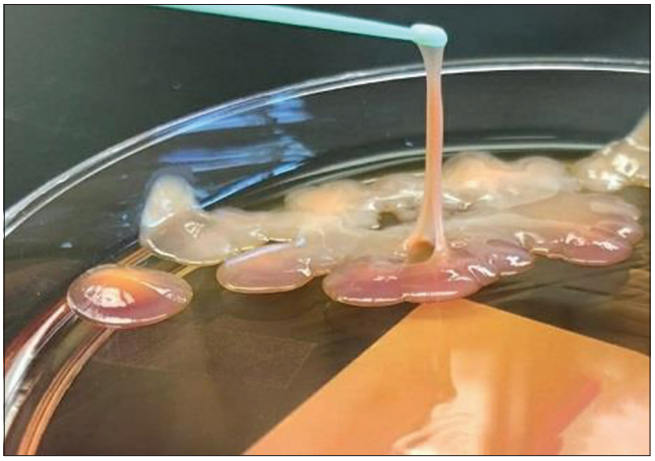

Figure 2: Positive string test (string formation of >5 mm when colony was touched with loop) demonstrating hypermucoviscosity of the *Klebsiella pneumoniae* isolate

the present case. KP-NF is an emerging life-threatening entity, predominantly encountered in patients with diabetes, chronic liver disease, and immunocompromised state.[5] The majority of the KP-NF cases have been reported from Taiwan,[5] where the hypervirulent *Klebsiella pneumoniae* (hvKP) have also emerged in the 1980s.[12] In recent years, there are reports of hvKP causing NF involving limbs.[13,14] 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.[15] The propensity of rapid metastatic spread to other organs such as eyes and lungs makes it a concern for primary care providers.[16] 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 anti-microbial 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[17] 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.

References

1. Puvanendran R, Huey JC, Pasupathy S. Necrotizing fasciitis. Can Fam Physician 2009;55:981-7.
2. McHenry CR, Piotrowski JJ, Petrinic D, Malangoni MA. Determinants of mortality for necrotizing soft-tissue infections. Ann Surg 1995;221:558-63.
3. Safran DB, Sullivan WG. Necrotizing fasciitis of the chest wall. Ann Thorac Surg 2001;72:1362-4.
4. Misiakos EP, Bagias G, Patapis P, Sotiropoulos D, Kanavidis P, Machairas A. Current concepts in the management of necrotizing fasciitis. Front Surg 2014;1:36.
5. Rahim GR, Gupta N, Maheshwari P, Singh MP. Monomicrobial Klebsiella pneumoniae necrotizing fasciitis: An emerging life-threatening entity. Clin Microbiol Infect 2019;25:316-23.
6. Mita N, Narahara H, Okawa M, Hinohara H, Kunimoto F, Haque A, *et al.* Necrotizing fasciitis following psoas muscle abscess caused by hypermucoviscous Klebsiella pneumoniae. J Infect Chemo 2012;18:565-8.
7. Ng D, Frazee B. Necrotizing fasciitis caused by hypermucoviscous Klebsiella pneumoniae in a Filipino female in North America. West J Emerg Med 2015;16:165-8.
8. Roje Z, Roje Z, Matić D, Librenjak D, Dokuzović S, Varvodić J. Necrotizing fasciitis: Literature review of contemporary strategies for diagnosing and management with three case reports: Torso, abdominal wall, upper and lower limbs. World J Emerg Surg 2011;6:46.
9. Jabbour G, El-Menyar A, Peralta R, Shaikh N, Abdelrahman H, Mudali IN, *et al.* Pattern and predictors of mortality in necrotizing fasciitis patients in a single tertiary hospital. World J Emerg Surg 2016;11:40.
10. Urschel JD, Takita H, Antkowiak JG. Necrotizing soft tissue infections of the chest wall. Ann Thorac Surg 1997;64:276-9.
11. Fayman K, Wang K, Curran R. A case report of primary necrotising fasciitis of the breast: A rare but deadly entity requiring rapid surgical management. Int J Surg Case Rep 2017;31:221-4.
12. Liu YC, Cheng DL, Lin CL. Klebsiella pneumoniae liver abscess associated with septic endophthalmitis. Arch Intern Med 1986;146:1913-6.
13. Chiu HHC, Francisco CN, Bruno R, Jorge Ii M, Salvaña EM. Hypermucoviscous capsular 1 (K1) serotype *Klebsiella pneumoniae* necrotising fasciitis and metastatic endophthalmitis. BMJ Case Rep 2018;11:e226096.
14. Zhu W, Xie K, Zhang X, Li X, Yang J, Xu L, *et al.* Monomicrobial Klebsiella pneumoniae necrotizing fasciitis with diabetic ketoacidosis: A case report and review of literature. Int J Clin Exp Med 2019;12:10962-7.
15. Russo TA, Marr CM. Hypervirulent Klebsiella pneumoniae. Clin Microbiol Rev 2019;32:e00001-19.
16. Sobirk SK, Struve C, Jacobsson SG. Primary Klebsiella pneumoniae liver abscess with metastatic spread to lung and eye, a North-European case report of an emerging syndrome. Open Microbiol J 2010;4:5-7.
17. Marr CM, Russo TA. Hypervirulent Klebsiella pneumoniae: A new public health threat. Expert Rev Anti Infect Ther 2019;17:71-3.