Section: Emergency Medicine

Original Research Article

TO STUDY BACTERAEMIA CAUSED BY TWO DIFFERENT PHENOTYPES OF KLEBSIELLA PNEUMONIAE

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ABSTRACT

Background: There are many illnesses that Klebsiella pneumoniae can cause, such as pneumonia, urinary tract infections, bacteremia, and liver abscesses. Historically, K. pneumoniae infections mostly happened to people whose immune systems weren't working well, leading to serious symptoms. Even so, the appearance and spread of hypervirulent strains have made healthy people more likely to get illnesses, even if their immune systems are strong.
Materials and Methods: The study was done at the Department of Emergency Medicine, Kamineni Academy of Medical Sciences and Research Centre, L.B Nagar, Hyderabad, Telangana, India, which offers a wide range of medical and surgery services except for burn, maternity, and child care. Every patient with bacteremia is routinely found every day by lab surveillance and is then assessed by an expert in infectious diseases. When the treating doctor thinks that bacteria are in the bloodstream, they take blood samples to grow the bacteria.
Results: Also, strains of K. pneumoniae are becoming more and more resistant to medicines, which makes it much harder to treat illnesses caused by these strains. The appearance of microorganisms that are highly pathogenic and immune to antibiotics has sparked a lot of new research. A type of bacteria that is resistant to drugs and an important part of the body's defense system called interleukin-17 have been seen to be spreading around the world. Some other factors have been found to be important in at least one infection model, even though there isn't a lot of research on the topic. But there are a lot of different types of K. pneumoniae strains, and not all aggressive Klebsiella strains play the same important role in every part. A new study has found more virulence factors in K. pneumoniae. It has also given us new information about the key factors that control the pathogen's growth in different tissue sites. It is important to know that many of these genes make proteins that guide transcription and metabolism.
Conclusion: More work needs to be done to fully understand and describe these newly found traits, figure out how infections differ between healthy people and people whose immune systems aren't working as well, and find possible treatment targets in the bacteria or the host.
Keywords: Phenotypes, oropharynx, bacteraemia, and Klebsiella pneumoniae.

INTRODUCTION

Because of more dangerous infections and a lack of good treatments, Klebsiella pneumoniae has recently become better known as a germ that causes disease. Because of the rise of K. pneumoniae strains that have gained new genetic traits and are now highly contagious or immune to antibiotics, these worrying events have happened. Klebsiella pneumoniae, which

used to be called Friedlander's germs, was found and separated for the first time in the late 1800s.[1-3]

The protective shell around this bacteria doesn't let it move, and it is classified as Gram-negative. It can be found in the ground, in open water, and on medical gear. This is important to know: K. pneumoniae can easily spread through the mucosal surfaces of the body, especially in the oropharynx and gastrointestinal system. In an interesting twist, its presence in these places doesn't seem to be hurting anything.[2-4] Different types of Klebsiella pneumoniae can get into different tissues from these places and give people serious infections. Instead of "an aggressive offense is the most effective strategy for a pathogen," the idea that "a strong defence is the most effective strategy for a pathogen" seems to explain why K. pneumoniae is such a tough disease. This is shown by the bacteria's ability to grow in many places inside humans and to avoid and survive several immune system parts instead of actively fighting them.[3-5]

This research is mostly about virulence factors of K. pneumoniae that have been studied a lot and are important in clinical settings. These factors play a role in at least one type of illness. It also has new virulence factors for K. pneumoniae that were found in recent studies.[6-8] To fully understand the roles of different factors in K. pneumoniae infections, we will talk about the different types of K. pneumoniae that cause serious diseases, the diseases that these strains cause, and the host factors that K. pneumoniae interacts with during infection [7-9]. The point of this study was to look into how often bacteremia caused by two different types of Klebsiella pneumoniae happened.

MATERIAL AND METHODS

The study was done at the Department of Emergency medicine, Kamineni Academy of Medical Sciences and Research Centre, L.B Nagar, Hyderabad, Telangana, India from April 2023 to March 2024, a specialized hospital that focuses on urgent medical and surgery care but does not offer services for children, pregnant women, or burn victims. Every patient with bacteremia is routinely found every day by lab surveillance and is then assessed by an expert in infectious diseases. When the treating doctor thinks that bacteria are in the bloodstream, they take blood samples to grow the bacteria. The double-disk synergy test was used to check isolates for the production of extended-spectrum beta-lactamases (ESBLs), and the ESBL E-test was used to make sure the results were correct. Using a computer-aided process, an expert in infectious diseases kept an eye on clinical samples that tested positive for ESBL-KP every day in the lab.

Methods

People who got K. pneumoniae bacteremia in the hospital were the focus of our study during an outbreak. A prospective group study was used to plan the study. The information gathered from the patients included their demographics, previous surgeries, the severity of their underlying disease based on the McCabe-Jackson criteria, the use of in situ devices, and drug use in the 14 days before they got bacteremia. We figured out how often K. pneumoniae bloodstream infections happened in ICU patients, since that's where most of the patients who got sick during the outbreak were.

Microbiological study

Traditional molecular methods were used to identify Klebsiella pneumoniae. The antibiotic resistance was checked with the Micro Scan TM automatic microdilution method and the E-test based on diffusion. It was proven by both the ESBL E-test and the double disk synergy test that ESBL output was happening. Using standard methods, chromosome macro-restriction tests were done with pulsed field gel electrophoresis.

RESULTS

There were 80 reports of people getting K. pneumoniae bacteremia in hospitals. Twenty of the people who were screened had ESBL-KP bacteremia and forty had non-ESBL-KP bacteremia. One or two episodes of ESBLKP bacteremia happened to forty different people, but only one person had two episodes of non-ESBL-KP bacteremia. In the ICU, the rate of K. pneumoniae bacteremia that was acquired in the hospital went up, mostly because of ESBL-KP bacteremia during the outbreak.

Table 1 displays the patients with and without ESBL-KP bacteremia are compared. In that age and gender wise distribution were added. [Table 1]

Table 2 displays the occurrence of Klebsiella pneumoniae bloodstream infection was assessed using a statistical analysis that considered just one variable at a time. [Table 2]

Table 1: Patients with and without ESBL-KP bacteremia are compared

Sr. No.	Variables	ESBL-KP	Non-ESBL-KP
1.	Age	59.18	59.5
2.	Sex (Male/Female)	34/15	31/14
3.	ICU Acquisition	22	18

Table 2: Klebsiella pneumoniae univariate analysis bacteraemia

Sr. No.	Variables		Died	Survived
1.	Age	<62 yrs.	3	35
		>62 yrs.	9	20
2.	ESBL	Yes	6	28

		No	5	30
3.	ICU Acquisition	Yes	8	32
		No	4	18

DISCUSSION

In the past few years, there has been a big rise in K. pneumoniae attacks because strains that make extended-spectrum B-lactamases are spreading all over hospitals around the world. Our hospital's intensive care units (ICUs) have been getting more and more K. pneumoniae bloodstream infections, especially during the outbreak.[9-11] This is mostly because of ESBL-KP, which is an extended-spectrum beta-lactamase-producing K. pneumoniae. There were big changes between the two groups in where the bacteremia came from. There were no differences in the number of intravascular tubes between the groups, but there were more cases of primary bacteremia in the ESBL-KP group.[12-14]

ESBL-KP bacteremia episodes happened a lot more often in ICU patients than in patients who did not have ESBL-KP. As a result, these patients had more treatments and were more likely to have the catheter manipulated incorrectly. In addition, ESBL-KP strains may be more likely to stick to systemic devices. Additionally, we saw that a lot of people who had an ESBL-KP bloodstream infection had already taken oxyimino-B-lactam drugs. The use of these drugs has been linked to the growth of ESBL-KP.[15-17]

There were no big changes between the two groups in overall or related death rates. The death rate for our patients with ESBL-KP bacteremia was 16%, which is about the same as the 18–20% death rate seen in cases of Gram-negative bacteremia. Studies from the past have shown that the death rate is higher when there is secondary bacteremia and lower when there is bacteremia caused by an intravascular device.[16-18] Because of how common primary bacteremia is and how important it is to remove catheters from these patients, which may have helped their overall prognosis, it is hard to judge how well antibiotic therapy works as a treatment. Even though there was a big difference between the two groups in the number of cases of inadequate antibiotic treatment in the first 48 hours, we were not able to find a link between inadequate antibiotic treatment and a higher chance of death.[17-19]

There isn't enough information out there right now about the best way to treat ESBLKP bacteremia. Ipenem, aminoglycosides, and B-lactam/B-lactamase inhibitors are the medicines used to treat ESBL-KP illnesses right now. Researchers used in vitro susceptibility testing and animal models to look at how well these drugs worked and come to this result. A lot of our patients responded well to imipenem, either by itself or in combination with tobramycin. There is still some disagreement about how to best use B-lactam/B-lactamase inhibitors to treat severe illnesses caused by ESBL-KP.[20-22] Several lab studies have shown that these drugs might be helpful, but they don't work as well as imipenem and aren't as strong unless they are used in very large amounts. In addition, studies show that these mixes didn't work when the strain that caused the infection showed resistance in lab tests. Four people were diagnosed with ESBL-KP bacteremia. After taking piperacillin/tazobactam, three of them got better. One patient, though, had a type of ESBL-KP that couldn't be treated, and they died even though they were given tobramycin and had their catheter taken out at the same time. Three of our patients got ESBL-KP bacteremia after taking piperacillin/tazobactam treatment. This was because they had bacteria that were resistant to the drugs.[23-25]

At the moment, carbapenems are thought to be the best way to treat ESBL-KP types because they always work against these infections. The fact that five of our patients who are taking imipenem got breakthrough bacteremia with ESBL-KP strains but not with non-ESBL-KP strains should not be seen as a sign of decreased activity.[24-26] This is most likely because imipenem isn't often given to people who are admitted to wards that aren't ICUs, where non-ESBL-KP bacteremia is more widespread. When patients were given imipenem medication, either by itself or with tobramycin, most of them had good clinical reactions. But because there aren't many people getting antibiotics.[25-27]

CONCLUSION

Our findings show that when ESBL-KP bacteraemia happens in an intensive care unit, hospital-acquired K. pneumoniae bacteraemia happens more often. This usually happens because of diseases caused by catheters. Even though ESBL wasn't found to be significantly linked to a bad result, antibiotic resistance can cause the wrong antibiotics to be used as a first line of defence, which raises the risk of death. Because carbapenems work against a wide range of bacteria, they should be the first treatment used when an ESBL-KP illness is suspected. Variable resistance makes it hard to use B-lactam/B-lactamase inhibitors, even though they can treat some illnesses caused by bacteria that are susceptible to them.

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