

Exploring the antibiotic susceptibility of nosocomial infection causative *Corynebacterium striatum* strains

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ABSTRACT

Introduction: *Corynebacterium striatum* (*C. striatum*) is one of the most frequently reported nosocomial infection agents among patients hospitalized in intensive care units following the COVID-19 pandemic. It may cause various opportunistic infections, such as ventilator-associated pneumonia and catheter-associated bloodstream infections, in such patients. The present study attempted to investigate the antibiotic susceptibility of 14 nosocomial infection agent *C. striatum* strains, isolated from deep tracheal aspirate and blood culture samples of hospitalized patients, for seven different antibiotics (benzylpenicillin, ciprofloxacin, clindamycin, rifampicin, linezolid, tetracycline, and vancomycin).

Material and Method: Antibiotic susceptibility of the strains for the mentioned antibiotics was determined utilizing a disk diffusion test in line with the recommendations of the European Antibiotic Susceptibility Committee (EUCAST).

Results: While all the isolated *C. striatum* strains (100%) were resistant to benzylpenicillin, tetracycline, rifampicin, ciprofloxacin, and clindamycin, we found none of them to be resistant to vancomycin and linezolid.

Conclusion: Overall, uncovering the antibiotic susceptibility of *C. striatum* strains isolated from clinical specimens would guide clinicians in deciding on the empirical treatment of hospital-acquired infections led by this agent.

Keywords: Nosocomial infections, *Corynebacterium striatum*, antibiotic susceptibility

INTRODUCTION

Nosocomial and community-acquired infections due to *Corynebacterium striatum* (*C. striatum*) have increasingly been reported in recent years. *C. striatum* is a Gram-positive bacillus that can be found as a flora element in the skin flora and nasal mucosa (1). Despite being considered a contaminant when isolated from clinical specimens, it may cause opportunistic infections in patients with risk factors (2). In this study, we attempted to investigate the antibiotic susceptibility of 14 nosocomial infection agent *C. striatum* strains, isolated from deep tracheal aspirate and blood culture samples of hospitalized patients, for seven different antibiotics (benzylpenicillin, ciprofloxacin, clindamycin, rifampicin, linezolid, tetracycline, and vancomycin).

MATERIAL AND METHOD

All strains included were isolated from patients hospitalized in the intensive care unit (ICU). We used VITEK-2 (bioMerieux, France), a fully automated bacterial identification system, to identify the strains and reveal their antibiotic susceptibility. In this study, we investigated the antibiotic susceptibility of *C. striatum* strains for benzylpenicillin, ciprofloxacin, clindamycin, rifampicin, linezolid, tetracycline, and vancomycin.

We utilized a disk diffusion assay to reveal the susceptibility of the strains to the said antibiotics. For this purpose, we used commercial discs of benzylpenicillin, ciprofloxacin, clindamycin, rifampicin, linezolid, tetracycline, and vancomycin (Bioanaliz, Türkiye).

Susceptibility findings were evaluated according to the criteria of the European Antibiotic Susceptibility Committee (EUCAST) (3).

RESULTS

While 12 (86%) of the strains were isolated from deep tracheal aspirate (DTA), 2 (14%) were obtained from peripheral and intracatheter blood samples. While all the isolated *C. striatum* strains (100%) were resistant to benzylpenicillin, tetracycline, rifampicin, ciprofloxacin, and clindamycin, we found none of them to be resistant to vancomycin and linezolid.

DISCUSSION

C. striatum is a sporeless, facultative, anaerobic, acid-resistant, non-staining, and Gram-positive bacillus. It usually colonizes the skin and upper respiratory tract. *Corynebacterium* species, other than *C. diphtheria*, are usually considered contaminants when isolated from clinical specimens.

C. striatum may cause life-threatening infections, such as infective endocarditis and bacteremia of undetected focus, in immunocompromised patients. Cases of bacteremia due to *C. striatum* are often reported especially in patients with end-stage renal disease (2).

It is also reported with increasing frequency in community-acquired and nosocomial infections. Especially multidrug-resistant *C. striatum* strains are reported in nosocomial infections or epidemics worldwide. In turn, invasive infections are reported in immunosuppressed and healthy patients due to these strains. The ability of the bacterium to form a biofilm contributes to the persistence of virulent *C. striatum* strains in the environment and the spread of antimicrobial resistance in the hospital environment. It is documented that multidrug-resistant *C. striatum* strains are often isolated from the respiratory tracts of patients with community-acquired and nosocomial infections. Severe invasive infections are observed in immunosuppressed patients, particularly those hospitalized for a long time, receiving antibiotic treatments, and/or using invasive medical devices (4).

C. striatum has been reported intermittently in infections (e.g., nosocomial bacteremia, central venous catheter infection, and endocarditis) in recent years (4). It is also known to cause meningitis, thrombophlebitis, and skin-soft tissue and orthopedic infections (5-7).

As expected, there has been a significant increase in the number of patients with *C. striatum* infection in the COVID-19 pandemic (8). When compared with previous periods, we also found a significant increase

in infection rates due to *C. striatum* strains during the COVID-19 pandemic.

The principal reason why *C. striatum* isolates have been reported more frequently as infectious agents may be related to the availability of rapid and accurate bacterium identification methods.

Rennie ve ark. (9) *Corynebacterium* türleri ve anaerob bakterilerin identifikasyonunda Vitek-2 otomatize sisteminin anaerob bakteriler ve *Corynebacterium* türleri için geliştirilmiş yeni identifikasyon kartlarının etkinliğini çok merkezli bir çalışmada değerlendirmişlerdir. Çalışmada klinik suşlarda %95.1 oranında doğru tanımlama, %5 oranında düşük ayırım, %4.6 oranında yanlış tanımlama, %0.3 oranında ise tanımlama yapılamamıştır. Çalışmada 20 *C. striatum* suşunun biri (*C. striatum* ATCC 6940 suşu) dışında tüm suşlar doğru (correctly) tanımlanmıştır.

Most *C. striatum* strains are resistant to penicillin, ceftriaxone, meropenem, clindamycin, and tetracyclines. The previous research documented that all 50 *C. striatum* isolates were resistant to daptomycin. In the same study, minimal inhibitory concentration (MIC)₅₀ and MIC₉₀ values for telavancin of *C. striatum* isolates were found to be 0.064 and 0.125 µg/ml, respectively, and no telavancin resistance was reported in the isolates (10).

In their systemic review, Milosavljevic et al. (11) discovered that multiple isolates of *C. striatum* are 100% susceptible to vancomycin, linezolid, teicoplanin, piperacillin-tazobactam, amoxicillin-clavulanate, and cefuroxime. In the same study, the authors determined that some strains show high resistance to quinolones, beta-lactams, aminoglycosides, macrolides, and most of the lincosamides and cotrimoxazole.

Kalt et al. (7) conclude no resistance to vancomycin and linezolid in 13 *C. striatum* strains isolated from bone and joint specimens of orthopedic patients. Similarly, we could not detect vancomycin and linezolid resistance in 14 *C. striatum* strains leading to nosocomial infections.

In Sweden, Bläckberg et al. (12) investigated *Corynebacterium* species and their antibiotic susceptibility among patients developing endocarditis due to *Corynebacterium* species. Their findings revealed the most frequently isolated *Corynebacterium* species to be *C. striatum*, followed by *C. jeikeum*. *Corynebacterium* species were mostly isolated from patients with a prosthetic valve. Moreover, a high rate of penicillin G resistance was detected in the strains, while vancomycin resistance was not reported.

In Canada, Neemuchwala et al. (13) studied 1,970 *Corynebacterium* isolates excluding *C. diphtheriae*, which mostly consisted of *C. striatum*, and discovered

penicillin resistance to be 85.5%, erythromycin resistance to be 85%, clindamycin resistance to be 91.3%, and ciprofloxacin resistance to be 73% in the strains. Contrary to these findings, we detected penicillin and ciprofloxacin resistance in all *C. striatum* strains in our study. In their research on *C. striatum* strains isolated from blood cultures of patients with hematological malignancies, Abe et al. (14) reported no linezolid and glycopeptide resistance in the isolated strains but concluded that all of the strains were resistant to daptomycin.

In Tunisia-based research, antibiotic resistance in 63 *C. striatum* strains isolated from different clinical samples was found to be 82.5% to penicillin, 79.4% to clindamycin, 48% to erythromycin, 36.5% to ciprofloxacin, and 25% to rifampicin. In the study, 59 (97.3%) of 63 isolates were resistant to at least one antibiotic, while 31 (49%) were found to be multi-drug resistant. While the strains were not resistant to vancomycin and linezolid, there was no daptomycin resistance, too, in contrast to other studies (15).

CONCLUSION

In the present study, we did not test the antibiotic susceptibility of *C. striatum* strains, which were isolated from various clinical specimens yet are non-causative agents of nosocomial infection. Therefore, the number of bacterial strains included in the study was relatively less when compared to the research in the literature.

We studied vancomycin resistance in *C. striatum* strains by disc diffusion technique instead of the reference technique (microdilution technique), which may be considered a limitation to our study

Overall, uncovering the antibiotic susceptibility of *C. striatum* strains isolated from clinical specimens would guide clinicians in deciding on the empirical treatment of hospital-acquired infections led by this agent.

ETHICAL DECLARATIONS

Ethics Committee Approval: Since there was no patient data in the study and only bacterial strains were studied, it does not require an ethics committee approval.

Informed Consent: Written informed consent was not obtained as the study was designed retrospectively and there were no patient data (only bacterial strains were obtained).

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper and that they have approved the final version

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