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Case Report OMICS International

Cornyebacterium striatum: an Emerging Bug

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Abstract

The increasing prevalence of chronic infections, with frequent exposure to broad-spectrum antibiotics for repeated and prolonged hospitalizations, favors the emergence of nosocomial infection by Gram-positive bacteria, such as outbreaks of *Corynebacterium striatum*. *Cornyebacteria* are gram-positive non spore forming rods. Many species are part of the normal skin and mucosal flora of humans. The clinical significance of *C. striatum* has recently been established. *C. striatum* has recently been reported to cause a variety of infections including pneumonia, endocarditis, septic arthritis, cerebrospinal fluid infection, surgical site infections and septicemia. In this study, describing three cases of *Corynebacterium striatum* that are attributed to health care associated infections and presented as post-surgical wound infection and hospital acquired pneumonia. The three cases include a case of a 68 years old lady who was readmitted with fever, pain and purulent discharge from surgical wound of the lower back, a 57 years old man who was readmitted 2 months after a road traffic accident with surgical wound infection of forearm and a 25 years old man on respiratory support after a head injury with ventilator associated pneumonia.

Keywords: *Cornyebacterium striatum*; Post-surgical wound infection; Hospital acquired pneumonia

Introduction

Cornyebacteria, gram-positive non spore forming rods, are widely distributed in the environment. Coryneform bacteria includes as a group of bacteria belonging to different genera. They are Gram positive non-motile rods that are catalase positive and oxidase negative with club shaped ends. The pattern is palisading. Funke et al. described an immense rise in the number of cases reported due to this genus. This was attributed to the increase of immuno-compromised patients susceptible, to improved microbiological diagnoses, and to a precise taxonomic classification that allows the correct identification of different species with different clinical expression [1]. Out of these, *Cornyebacterium diphtheria* is mainly recognized as human pathogen. Most of the *Corynebacterium* other than *C. diptheriae* was referred to as "diptheroids" often considered as a part of normal skin commensal flora of human being or contaminants without any clinical relevance. However, the clinical significance of some of these species has recently been ascertained; some of these include *C. striatum*, *C. amycolatum*, *C. jeikium*, *C. macginleyi*, *C. urealyticum*, *C. pseudodiphtheriticum* and less frequently with *C. xerosis* [2].

C. striatum infections involving the skin have also been reported in normal host. *C. striatum* has recently been reported to cause a variety of infections including pneumonia, endocarditis, septic arthritis, cerebrospinal fluid infection, surgical site infections and septicemia [3-6]. This study describe three cases of post-surgical wound infection and hospital acquired pneumonia caused by this species.

Clinical Reports

Case 1

A 68 years old lady was admitted on March 28, 2016 with fever, pain and purulent discharge from surgical wound of the lower back. She was hypertensive and diabetic. She underwent transforaminal lumber interbody fusion with delta fixation of 4th and 5th lumber vertebra due to spondylolisthesis on 11th March 2016. Postoperative she remained well except mild soakage of dressings. She was discharged on fourth postop day on oral antibiotics. On fifth postoperative day she noticed purulent discharge from surgical site with increasing pain. She remained on oral antibiotics initially but due to persistent pus discharge she was started on parenteral third generation cephalosporins and aminoglycosides. However, she developed intermittent high grade fever. She was readmitted on the seventeenth post-operative day. Laboratory reports revealed total leucocyte count of 13.4 × 10^9/l, red blood cell count of 3.60 × 10(12)/l, hemoglobin of 8.8 g/dl, differential leukocyte count neutrophils 85%. Her C-reactive protein (CRP) was 32 IU/l and ESR 36 mm at first hour. Fasting plasma glucose was 7.5 mmol/l; urea 6.6 mmol/l and creatinine 68 µmol/l. Wound debridement was done which revealed dislodged screws with collection of pus. Pus was aspirated deep beneath the myocutaneous plane and sent for culture and sensitivity. In the laboratory, pus revealed Gram positive rods in palisade arrangement with numerous pus cells. Sample was inoculated on blood agar (Oxoid UK), MacConkey agar (Oxoid UK) aerobically and Wilkins- Chalgren Agar (Oxoid UK) anaerobically. After 24 h of incubation, small greyish white non hemolytic colonies were observed on blood agar plate. Staining revealed short Gram positive rods with Chinese letter configuration. Isolate was identified as *C. striatum* biochemically (API coryne, bioMérieux, France). Antibiotic susceptibility testing was performed by agar dilution method for minimum inhibitory concentration (MIC) determination by multipoint inoculators system as per Clinical and Laboratory Standard Institute guidelines [2]. The isolate was found to be susceptible to vancomycin (2 µg/ml), linezolid

(4 µg/ml) and rifampicin (1 µg/ml). It was resistant to amikacin (64 µg/ml), erythromycin (8 µg/ml), Clindamycin (4 µg/ml), ciprofloxacin (4 µg/ml) and gentamicin (16 µg/ml).

Injection vancomycin was started with daily antiseptic dressings. Two units of RCC were transfused and plasma glucose was controlled with insulin. Redo surgery was done and dislodged screws were removed. Bone was cemented and augmented screws were placed to provide stability to vertebra. Vancomycin was continued for four weeks with monitoring of renal function tests. Daily dressing was continued and she was discharged on linezolid 600 mg orally 12 hourly for four weeks. Patient reported back after three weeks and was completely cured of the infection.

Case 2

A 25 years old man was admitted on September 15, 2016 with head injury due to fall two days back. He was bleeding from the left ear. He had breathing difficulty and vomiting which was followed by a brief loss of consciousness. There was no history of fits. X-ray skull revealed no fracture. However, CT-scan of the head revealed tension pneumocephalus. He was operated and a ventriculoperitoneal shunt was inserted along with a tracheostomy tube. Chest X Ray revealed atelectasis on left hand side. Postoperatively the patient remained on ventilator support. Laboratory analysis revealed total leucocyte count of 15×10^9/l, red blood cell count of $2 \times 10(12)$/l, hemoglobin of 7.6 g/dl with neutrophils 90%. His C- reactive protein was 36 IU/l and ESR 36 mm at first hour. Liver and renal function tests were within normal limits. On the second postoperative day, he developed high grade fever. Patient was started on sulbactam/cefeperazone and colomycin. He underwent brochoscopy through tracheostomy tube and endobronchial secretions were sent to microbiology laboratory. Staining revealed predominantly Gram positive rods with V and L shaped appearance. Sample was processed as per protocol. After 24 h of incubation small greyish white non hemolytic colonies and transparent mucoid oxidase positive colonies were observed on blood agar plate. Isolate was identified as *C. striatum* biochemically (API coryne). The second isolate with transparent oxidase positive colonies were gram negative rods. It was identified as *P. aeruginosa* by API 20NE. Antibiotic susceptibility testing by agar dilution method revealed *C. striatum* sensitive to erythromycin (0.25 µg/ml), vancomycin (1 µg/ml) and linezolid (4 µg/ml). It was resistant to ciprofloxacin (4 µg/ml), chloramphenicol (32 µg/ml), rifampicin (8 µg/ml), Penicillin (32 µg/ml) and clindamycin (4 µg/ml). *Pseudomonas aeruginosa* was sensitive to imipenem (0.5 µg/ml), meropenem (0.25 µg/ml), polymixin B (0.125 µg/ml), tazobactam/piperacillin (2/0.5 µg/ml) and resistant to gentamicin, amikacin, ciprofloxacin, levofloxacin, aztreonam, cefipime and ceftazidime. Intravenous vancomycin and polymyxin B were started; patient responded to treatment.

Case 3

A 57 years old man, known case of Hepatitis C and diabetes mellitus, presented to the emergency department on 30th July 2016 with history of road traffic accident. There was fracture of the right acetabulum and sacrum along with open fracture of the radius and ulna. External fixation was done and he was discharged. He was re-admitted after two months with infected wound. Laboratory analysis revealed total leucocyte count of 13×10^9/l, red blood cell count of 2.4 $\times$ 10(12)/l, hemoglobin of 12.1 g/dl with neutrophils 90%. His ESR was 45 mm at first hour. Fasting plasma glucose was 9 mmol/l; Serum ALT 55 U/l, serum albumin 34 g/l, and serum alkaline phosphatase was 261 IU/l. External re-fixation was done with cleaning of infected area. However, patient developed discharge from wound. Wound debridement was done the following day. Staining revealed predominantly V and L shaped Gram positive rods. Sample was processed as per protocol. After 24 h of incubation, culture yielded similar colony morphology of *C. striatum* as discussed earlier. Isolate was identified as *C. striatum* on API coryne. The second isolate with transparent oxidase positive colonies were gram negative rods. It was identified as *Pseudomonas aeruginosa* on API 20NE. *C. striatum* was susceptible to vancomycin (0.5 µg/ml) and linezolid (2 µg/ml). It was resistant to ciprofloxacin (4 µg/ml), erythromycin (8 µg/ml), penicillin (1 µg/ml), chloramphenicol (32 µg/ml), rifampicin (8 µg/ml) and clindamycin (8 µg/ml). The patient was treated on vancomycin and polymyxin B, he responded well.

Discussion

In the pre-antibiotic era, gram-positive bacteria were responsible for most severe infections; however, since the 1940's and with the introduction of penicillin, there has been an increase in infections being caused by gram negative bacteria until the sixth and seventh decades of the last century. Since then, a number of factors including the increasing use of broad-spectrum antibiotics for an increasing number of patients with severe chronic diseases, and the application of more aggressive and invasive diagnostic and therapeutic procedures have produced a resurgence of gram-positive bacteria with multi resistance to antibiotics, leading to a high morbidity and mortality rate. At the forefront is methicillin-resistant *Staphylococcus aureus*, but other genera have also acquired worrisome momentum, such as *Corynebacterium* spp. Cornyeform bacteria are part of the normal skin flora. For this reason, they had earlier been disregarded as contaminants; however, they are now being implicated in a variety of health care associated infections [7]. *C. striatum* is an emerging pathogen with multi-drug resistance potential [8]. Infections caused by *C. striatum* include respiratory tract infections, endocarditis, septic arthritis, cerebrospinal fluid infections, wound infections and septicemia [3,5,6].

A variety of case reports and various nosocomial infectious outbreaks of *C. striatum* have been reported mostly in patients with chronic diseases requiring frequent and prolonged hospitalizations with repeated exposure to antibiotics against Gram-negative bacteria, organic obstructive disorders, or exposed to invasive procedures that disrupted the skin barrier. Most reported *C. striatum* infections have been found in respiratory samples, the vast majority of strains being multidrug-resistant. That's why this pathogen has been reported on a variety of occasions to cause respiratory tract infections like pneumonia, empyema [9] and pulmonary abcesses [8,10]. Infections caused by *C. striatum* usually occur in the immunocompromised or in hospitalized individuals. *Corynebacterium striatum* has been reported to colonize prostheses, catheter tips, ventilators and feeding tubes. It has been also identified as a causative agent in cases of endocarditis, sepsis and bacteraemia. Several outbreaks of infections have been reported [8].

From different published cases it seems that the infection is nosocomial and immune compromised people are more susceptible to it. Rizvi M et al. reported that a majority of patients had been hospitalized for many days [7]. In the first case that we are reporting, *C. striatum* caused wound infection. Diabetes was among the predisposing factors. This pathogen has been known to cause wound

infections earlier also [11,12]. Superti et al. reported a case of *C. striatum* skin and soft tissue infection of a malignant skin lesion in a 27 y old male patient. This clearly indicates that this bacterium has a predilection for devitalised cutaneous and soft tissue [13]. The other case that we are reporting is a respiratory tract infection caused by the same bacterium. The bacteria is notorious for causing respiratory tract infections [14]. Multi drug resistant *Cornyebacterium* species are rapidly emerging [15,16]. Usually *C. striatum* shows excellent susceptibility to vancomycin. Hahn WO et al. reported a total of 71% (n=121) of isolates resistant to penicillin, tetracycline, clindamycin, erythromycin and ciprofloxacin [15,16]. In the first case *C. striatum* that we isolated was susceptible to vancomycin and linezolid. In the second case it was susceptible to vancomycin, linezolid and erythromycin. Another study in Spain where *C. striatum* isolates from 51 advanced respiratory patients, mainly chronic obstructive pulmonary disease, and 56.9% specimens had *C. striatum* isolates in pure culture, in 26.4% they were accompanied by *P. aeruginosa*, in 8.3% by *Stenotrophomonas maltophilia*, and by other bacteria in 8.3% cases [17,18]. In second and third case *C. striatum* is accompanied by *P. aeruginosa*. Stone et al. reported a case of recurring breast abscess that required several drainage procedures over a seven week period in a 41 y old immune competent woman with no underlying medical condition.

These cases in the report are somewhat comparable to the previous susceptibility data. Vancomycin was susceptible in both cases. One thing that can be observed here is that *C. striatum* is an emerging multi drug resistant pathogen.

Conclusions

C. striatum is now an established pathogen, both in immunocompromised and immunocompetent patients. It is increasingly being reported to cause infection in long standing open wounds. *C. striatum* is a health concern because it is an emergent Gram-positive environmental bacterium, prevalent, highly persistent and transmissible person-to-person and through caregivers, with multidrug resistance, that can cause opportunistic severe infection and long-term airway colonization in patients with advanced chronic respiratory disease (older, more obstructed and poorly perfused, with frequent and prolonged hospitalizations, exposed to repeated cycles of antibiotics), and often the cause of outbreaks of respiratory nosocomial infection. Antibiotic therapy with a glycopeptide while awaiting culture- sensitivity report of a particular isolate could benefit the outcome. This along with appropriate measures can limit its role as a nosocomial pathogen. Prevention should be based on guideline-based management of advanced respiratory disease, enforcing hygiene measures in caregivers and therapeutic devices. Treatment should be according to antibiogram or, should it be unavailable, with vancomycin.

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