Infection (2019) 47:1055–1057
https://doi.org/10.1007/s15010-019-01300-x

CASE REPORT

An unusual case of post-trauma polymicrobial cutaneous diphtheria

Aishwarya Govindaswamy[1] · Vivek Trikha[2] · Anupam Gupta[2] · Purva Mathur[1] · Samarth Mittal[2]

Received: 6 March 2019 / Accepted: 18 March 2019 / Published online: 5 April 2019

Abstract
We report a rare case of post-traumatic cutaneous diphtheria in a patient referred from a hospital in rural India. The diagnosis of cutaneous diphtheria was confirmed by the isolation of *Corynebacterium diphtheriae* cultured from the ulcer of the leg, along with *Staphylococcus aureus, Streptococcus pyogenes*, and *Arcanobacterium haemolyticum*. The patient was kept on isolation and treated with erythromycin for 14 days without antitoxin. He was discharged when his subsequent cultures turned out to be negative. Chemoprophylaxis was also given to his family members. Such a case highlights the revisiting of vaccination strategies and the role of cutaneous carriers in transmission of this deadly disease.

Keywords *Corynebacterium diphtheria* · Cutaneous diphtheria · Road traffic accident (RTA) · Chemoprophylaxis · MALDI-TOF MS

Introduction

Cutaneous diphtheria is an infection of the skin caused by either toxigenic or non-toxigenic strains of *Corynebacterium diphtheriae* (*C. diphtheriae*) [1]. It is usually a complication of pre-existing cutaneous lesions which include traumatic abrasions, surgical wounds, burns, insect bites, pyoderma, eczema, impetigo, dermatitis which causes a breach in the skin surface [2]. Cutaneous diphtheria rarely develops into an invasive disease. Cutaneous diphtheria is more contagious than respiratory diphtheria. Organism shedding from the skin lesions can be more prolonged thereby contaminating the environment through dust and fomites leading to respiratory and cutaneous infections in susceptible individuals [3]. Here we report a case of cutaneous infection caused by *C. diphtheriae* admitted in our tertiary care centre.

Case report

A 33 year old male had a history of road traffic accident (RTA) following which he sustained a fracture of right tibia, for which he underwent open reduction and internal fixation of right tibia using a locking plate in a rural setup elsewhere. Postoperatively, he developed local infection as a result of which he developed a large skin defect over lateral aspect of the right leg with an exposed implant (starting 3 cm below knee upto 4 cm above ankle). Patient underwent a medial gastrocnemius muscle flap reconstruction along with split-thickness skin graft for the defect. However, a few weeks later, the muscle flap also got infected along with appearance of discharging sinuses. The patient underwent two staged procedures with induced membrane technique and was stabilised with limb reconstruction system (LRS) in view of infected non-union of right leg.

The patient was discharged and subsequently came for follow-up in the outpatient department (OPD) with an infected wound along with a discharging sinus. On presentation in OPD, he had multiple, inflamed, punched out lesions on his right shin approximately 1 cm in diameter along with pus exudate as shown in Fig. 1. The wound was swabbed and sent to the microbiology laboratory and the patient was started on a combination of oral amoxicillin and clavulanic acid (625 mg three times a day). *C. diphtheriae, Staphylococcus aureus, Streptococcus pyogenes*, and *Arcanobacterium haemolyticum* (*A. haemolyticum*) were

✉ Samarth Mittal
samarthmittal@gmail.com

[1] Department of Microbiology, Jai Prakash Narayan Apex Trauma Centre, All India Institute of Medical Sciences, New Delhi, India

[2] Department of Orthopedics, Jai Prakash Narayan Apex Trauma Centre, All India Institute of Medical Sciences, New Delhi, India

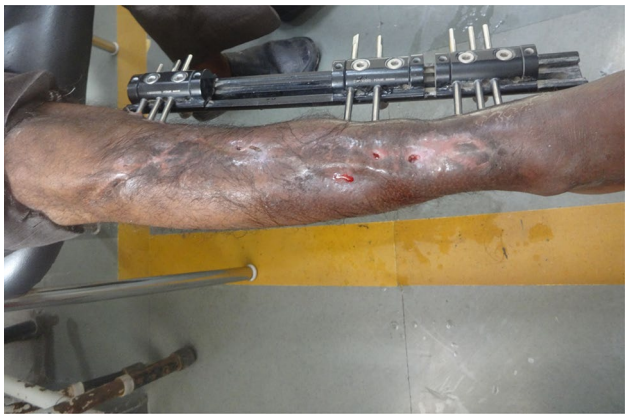

Fig. 1 Multiple, red, inflamed, punched-out lesions on the right shin

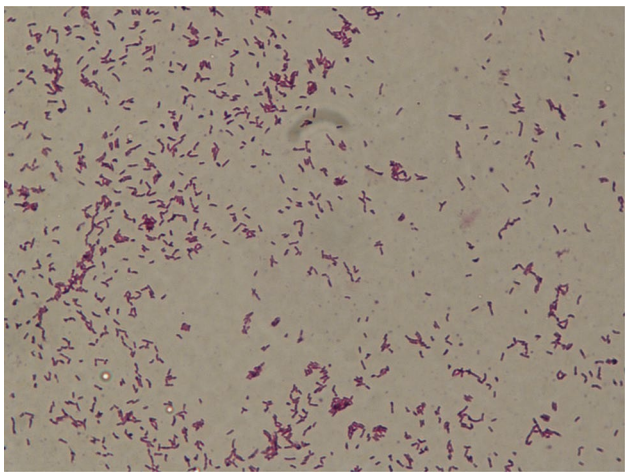

Fig. 2 Gram stain picture of *Corynebacterium diphtheriae* showing Gram-positive bacilli

isolated from the wound culture. The organisms were identified using matrix-assisted laser desorption/ionisation time of flight mass spectroscopy (MALDI-TOF MS), Biotyper OC, version 3.1 (Bruker Daltonics, Bremen, Germany). The Gram stain slide of *C. diphtheriae* is shown in Fig. 2.

Following these results, the patient was contacted and immediately asked to return for readmission and treatment. The patient was kept in isolation with all standard and contact precautions during his stay in the hospital. Repeat samples were taken from the patient's lesions. Swabs were also taken from the patient's throat and nose and screened for *C. diphtheriae*. Throat and nasal swabs were also taken from the patient's family members. Chemoprophylaxis was also given to the family members. It was uncertain to decipher from the patient history whether he had ever received a primary diphtheria immunization course partially owing to lack of patient records and poor socio-economic and educational background. The patient was started on oral erythromycin 500 mg four times a day for 14 days. The patient's wound were dressed regularly. The patient was kept on contact isolation until cultures from throat, nose and wound came out negative. Following 2 weeks of treatment, the skin lesions improved and repeat cultures did not have any growth of *C. diphtheriae*.

Discussion

The incidence of diphtheria has declined in both the developed and the developing countries, due to effective immunization programs. According to the World Health Organisation (WHO) report the number of cases had declined from 100,000 cases in 1980–2500 cases in the year 2015 [4]. However, due to low vaccine coverage and waning of vaccine immunity in adults, there has been a re-emergence of the disease in many countries. India accounts for a major proportion of diphtheria contributing to nearly half of the global burden with several outbreaks recently documented in the literature [5, 6].

Cutaneous diphtheria is frequently seen in the tropics and subtropical regions. The typical manifestation of cutaneous diphtheria is chronic non-healing ulcers developing over a period of weeks to months. The lesions usually begin as a vesicle or pustule progressing to multiple punched-out lesions covered with a pseudo membrane. The common sites include the lower legs, feet, and hands. Bacterial co-infection most notably with *S. aureus* and *S. pyogenes* is very common which might mask the corynebacterium leading to delay in the diagnosis of cutaneous diphtheria.

In the developing countries with warm climates, cutaneous diphtheria serves to boost the immune system without the risks, signs and symptoms of classic diphtheria, which could be responsible for the continuous circulation of the disease [4]. Cutaneous carriage of this pathogen, in the face of waning herd immunity over time could risk the occurrence of outbreaks in close clusters. Factors favouring the spread include poverty, overcrowding, poor hygiene, frequent traumatization of unprotected skin and insect bites. Clinical suspicion of cutaneous diphtheria depends on morphological and epidemiological features. Definitive diagnosis depends on culturing the organism [7]. The wound culture in our case was predominantly polymicrobial along with methicillin-resistant *S. aureus* (MRSA), *S. pyogenes*, and *A. haemolyticum*. This was similar to the previously published reports [8, 9]. *A. haemolyticum* is usually implicated in causing pharyngeal infections. These are reported to cause polymicrobial skin and soft tissue infections similar to our case study [10].

Penicillin or erythromycin is usually considered to be the first-line treatment of nontoxigenic cutaneous diphtheria [11]. Antibiotics do not alter the course, outcome of

infection or the incidence of complications. However, they are beneficial in eliminating the carrier state and to terminate toxin production [12]. Since our case did not have any toxic symptoms he was not given antitoxin. Elimination of the organism is usually documented by two consecutive negative cultures after therapy is completed.

At present, diphtheria control and elimination solely depends on immunization. Despite continued efforts the coverage of diphtheria–tetanus–pertussis (DTP3) vaccination in India is between 80 and 90% for the past 15 years. WHO/UNICEF estimates are even lower. Currently, it might take several decades to achieve complete immunization coverage in India which can lead to further deaths due to the vaccine preventable nature of the disease. This can be prevented by ensuring the availability of diphtheria antitoxin (DAT) to the suspected cases in the outbreak locations and vulnerable regions and complete immunization coverage [13].

Conclusion

To conclude, cutaneous diphtheria is often undiagnosed due to nonspecific clinical presentation and polymicrobial infection. Thus, any chronic non-healing ulcer should arouse the suspicion of cutaneous diphtheria among the clinicians and microbiologists. Wound swabs obtained from these patients should be looked for *C. diphtheriae*. Being highly contagious, it requires early diagnosis and reporting to trigger rapid and effective public health control measures.

Funding This work did not require any external funding.

Compliance with ethical standards

Conflict of interest The authors have no conflicts of interest to declare.

Ethical standards A written consent was obtained from the patient for publication.

References

1. Surveillance Manual|Diphtheria|Vaccine Preventable Diseases|CDC [Internet]. 2018. https://www.cdc.gov/vaccines/pubs/surv-manual/chpt01-dip.html. Accessed 25 Oct 2018.
2. Livingood CS, Perry DJ, Forrester JS. Cutaneous diphtheria: a report of 140 cases 1. J Invest Dermatol. 1946;7:341–64.
3. Abdul Rahim NR, Koehler AP, Shaw DD, Graham CR. Toxigenic cutaneous diphtheria in a returned traveller. Commun Dis Intell Q Rep. 2014;38:E298–300.
4. Clarke K. Review of the epidemiology of diphtheria 2000–2016. World Health Organisation, Geneva. 2017.
5. Sangal L, Joshi S, Anandan S, Balaji V, Johnson J, Satapathy A, et al. Resurgence of diphtheria in North Kerala, India, 2016: laboratory supported case-based surveillance outcomes. Front Public Health [Internet]. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5582196/.
6. Murhekar M. Epidemiology of diphtheria in India, 1996–2016: implications for prevention and control. Am J Trop Med Hyg. 2017;97:313–8.
7. Koopman JS, Campbell J. The role of cutaneous diphtheria infections in a diphtheria epidemic. J Infect Dis. 1975;131:239–44.
8. Lowe CF, Bernard KA, Romney MG. Cutaneous diphtheria in the urban poor population of Vancouver, British Columbia, Canada: a 10-year review. J Clin Microbiol. 2011;49:2664–6.
9. de Benoist A-C, White JM, Efstratiou A, Kelly C, Mann G, Nazareth B, et al. Imported cutaneous diphtheria, United Kingdom. Emerg Infect Dis. 2004;10:511–3.
10. Tan TY, Ng SY, Thomas H, Chan BK. *Arcanobacterium haemolyticum* bacteraemia and soft-tissue infections: case report and review of the literature. J Infect. 2006;53:e69–74.
11. Wilson AP. Treatment of infection caused by toxigenic and non-toxigenic strains of *Corynebacterium diphtheriae*. J Antimicrob Chemother. 1995;35:717–20.
12. Bennett JE, Dolin R, Blaser MJ Mandell, Douglas, and Bennett's principles and practice of infectious … Google Books [Internet]. https://books.google.co.in/books?id=73pYBAAAQBAJ&printsec=frontcover&dq=mandell+8th+edition&hl=en&sa=X&ved=0ahUKEwjs34y6id7eAhXPTn0KHXr4C-4Q6AEIKDAA#v=onepage&q=mandell%208th%20edition&f=false. Accessed 18 Nov 2018
13. ICMR_NITM_ROY_Policy_Brief_Diptheria_Final_2017.pdf [Internet]. https://www.icmr.nic.in/sites/default/files/policy_brief/ICMR_NITM_ROY_Policy_Brief_Diptheria_Final_2017.pdf. Accessed 10 Feb 2019.