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Fetal case of diphtheria reported to CDC emergency operations

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ABSTRACT

Unreported cases of diphtheria are still present in developing countries. A 9-year-old incompletely vaccinated girl was admitted with pharyngotonsillitis caused by diphtheria. On day 9 of her illness, renal and cardiac failure occurred. Unfortunately, she died within hours of admission to intensive care with cardiogenic shock despite the vigorous supportive care delivered to her and the administration of antibiotics and diphtheria antitoxin. The suboptimal dose of antitoxin administered initially upon admission to hospital was likely to have contributed to the unfavorable outcome.

1. Introduction

Diphtheria is endemic in many countries worldwide, and it remains sporadic in the created nations. Administration of medication along with diphtheria antitoxin (DAT) at an early stage is critical to avoid fetal complications, which consequently could end in mortality. Urgent administration of antitoxin is vital, as it will deactivate the free toxin in the serum before it enters into the cells, causing an irreversible process.

Respiratory diphtheria is an infection of the upper respiratory tract characterized by sore throat, fever, and a disciple pseudomembrane that can cover the tonsils and the mucosa of the pharynx, larynx, and nose. Occasionally, the mucosa of the eyes, ears, or even genitalia could be affected. This is mainly due to the exotoxin-producing strains of *Corynebacterium diphtheriae* but may also be due to other corynebacteria that produce the diphtheria toxin, for example, *Corynebacterium ulcerans* or *Corynebacterium pseudotuberculosis* [1]. The toxin causes tissue putrefaction and development of the pseudomembrane. It additionally creates significant myocarditis and neuritis.

Cutaneous diphtheria usually is an indolent, nonprogressive infection characterized by a superficial, ecthymic, nonhealing ulcer with a gray-brown membrane. Rare cases of septicemia caused by *C. diphtheriae* have been described, and such cases are often fatal [2].

1.1. Case report

A 9-year-old girl was referred to the Almokala University Hospital for low-grade fever and sore throat; her condition subsequently worsened, and she experienced swelling of the neck and dysphagia. The patient was born at a rural hospital in Yemen with an uneventful neonatal history. She had received Bacillus Calmette-Guérin and hepatitis B vaccinations at birth but not any other additional vaccinations. She had no known previous medical problems. She lived with four other people, namely, her mother, father, aunt, and cousin. The patient had a history of close contact with other sick patients, where her 6-year-old brother died two days before her admission due to acute febrile illness.

Upon initial assessment, the patient was ill-looking, not in respiratory distress, and with normal color appearance. Vital signs demonstrated that the patient was febrile (38.5 °C), had tachycardia (130 bpm), average respiratory rate (20 breaths/min), and normal blood pressure (110/70 mm Hg). Her weight was 22 kg (10th centile). Examination revealed swelling of the right side of the neck tissue that was soft, tender, and without fluctuation and with healthy skin overlying. Her pharyngotonsillar area was inflamed and had white patches with enlarged tonsils. Her lungs were bilaterally clear to auscultation. Another systemic examination was unremarkable.

A complete blood count was notable for hemoglobin (13.5 g/dL), with a white blood cell count of 11,700 cells/mm^3 (neutrophils 88%,

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lymphocytes 3%) and a platelet count of 95 000/mm^3. The patient's blood urea nitrogen (51 mg/dL) and creatinine (1.0 mg/dL) were elevated at admission. A throat swab Gram stain showed gram-positive bacilli. A throat swab culture showed *C. diphtheriae*.

The troponin T level was 74 ng/mL (standard <14) and creatine kinase-MB level was 7.6 ng/mL (standard 0.63–5.1). Pro-brain natriuretic peptide was 1236 ng/L (standard <355 ng/L for age 8–13 years).

On day 1 of hospitalization, the patient was started on DAT (20 000 units intravenously, after hypersensitivity testing), penicillin G (200 000 U/kg/day intravenously every 6 h), and ceftriaxone (100 mg/kg/day intravenously once daily).

On day 3 of admission, the patient developed abdominal pain associated with vomiting, ultrasound of the abdomen showed mild ascetic fluid collection, renal function tests showed increased blood urea nitrogen (67 mg/dL) and creatinine (2.2 mg/dL), and the creatine kinase-MB level was 66 IU/L. (standard 5–25 IU/L).

As the patient did not receive a proper initial dose of DAT, which is 100,000 IU in severe diphtheria [3,4], e.g., ("bull neck"), we contacted the Centers for Disease Control and Prevention (CDC) in the USA regarding re-dosing of DAT. They recommended considering redosing the DAT at the full 80,000 units given the child's clinical deterioration, although, according to them, there were no data regarding how effective redosing would be in this circumstance. After a couple of days of illness, it is unknown how much toxin would be circulating and therefore available to bind to the antitoxin, as it is possible that most of the toxin could already have entered the child's tissue.

Her condition continued to worsen until day 9 of admission when she developed generalized edema and hypotension with diminished urine output. Before arrangements for the DAT remaining dose, the patient was declared dead in the intensive care unit despite the vigorous supportive care delivered to her. We believed that the patient developed acute myocarditis, which progressed to cardiogenic shock.

As diphtheria disease is re-emerging, especially in developing countries and among the unvaccinated children, we strongly recommend that the DAT should be available at least at reference national health institutes. Further, there should be increasing awareness among the health care providers that early delivery of the appropriate DAT dose could end in a favorable outcome.

Ethical statement for solid state ionics – diffusion and reactions

I testify on behalf of all co-authors that our article has been submitted to Solid State Ionics – Diffusion and Reactions:

1) This material has not been published in whole or in part elsewhere;
2) The manuscript is not currently being considered for publication in another journal;
3) All authors have been personally and actively involved in substantive work leading to the manuscript and will hold themselves jointly and individually responsible for its content.

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