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# Case Report: A 5 Year Old Girl With Diphtheria

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**KEYWORDS**
Diphtheria, Clinical Symptoms, Complications, Therapy

**ABSTRACT**
Background: Diphtheria is an acute infectious disease caused by Corynebacterium diphtheriae. It is characterized by the formation of pseudomembranes in the tonsils, pharynx, and/or nasal cavity, which can lead to severe complications such as airway obstruction, myocarditis, and paralysis of the palate muscles. Aims: This study aims to detail the clinical course and treatment of a pediatric diphtheria case, emphasizing the importance of early diagnosis and appropriate therapeutic interventions. Methods: The case of a 5-year-old girl presenting with a 3-day history of fever at K.R.M.T Wongsonegoro Hospital is described. Clinical evaluation, including history, physical examination, and supportive tests, led to a diagnosis of diphtheritic tonsillitis. Findings: The patient exhibited classic symptoms of diphtheria, including sore throat, fever, and the presence of a dirty, greyish-white pseudomembrane on the tonsils. The membrane extended to adjacent structures, causing a condition known as bullneck. The treatment protocol included the administration of diphtheria antitoxin (DAT), antibiotics, antipyretics, corticosteroids, and symptomatic management. Conclusion: Diphtheria remains a serious infectious disease requiring prompt diagnosis and treatment to prevent complications. The case highlights the importance of early intervention, continuous monitoring, and the evaluation of therapeutic efficacy to improve patient outcomes. Implications: This study underscores the necessity of vigilant clinical practices in managing diphtheria cases, particularly in pediatric patients, to reduce morbidity and mortality.

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## INTRODUCTION

Diphtheria is an acute disease caused by Corynebacterium diphtheria, a gram-positive facultative anaerobic bacterium (Daniels & Sykes, 2021a). This disease is characterized by sore throat, fever, and malaise and on examination, pseudomembranes are found in the tonsils, pharynx, and/or nasal cavity.1 Diphtheria is a disease that is transmitted through direct contact or droplets of the affected. A typical examination shows the pseudomembrane appears dirty and greyish white in colour, which can cause blockage due to inflammation of the tonsils and extends to adjacent structures, which can cause bullneck (Binks, 2022). The membrane bleeds easily when removed.

Infection is spread via droplets, direct contact with the respiratory tract secretions of sufferers or from carrier sufferers (Niazi, Groth, Spann, & Johnson, 2021). In endemic areas, 3%-5% of healthy people can carry toxigenic diphtheria germs. C. diphtheriae germs can survive in dust or outside air for up to 6 months. 2 Manifestations of this disease can vary from asymptomatic to severe and fatal. The primary factors are host immunity, virulence and toxigenicity of C. diphtheriae (the ability of the germ to form toxins) and the anatomical location of the disease. Diphtheria has a germination period of 2-6 days.

Rapid diagnosis must be made immediately based on clinical symptoms and laboratory (throat swab, culture, or PCR) for early treatment. Management consists of the use of specific antitoxins and the elimination of the causative organism (Kamruzzaman, Wu, & Iredell, 2021). Complications of diphtheria can cause airway obstruction, myocarditis, palate muscle paralysis, and otitis media. It can also spread to the lungs, causing pneumonia. Prevention by immunization, carrier treatment, and use of PPE.

This study describes the case of a 5 year old girl who was infected with diphtheria from the time she came to the hospital until treatment was given to the patient.

**Case Illustration**

A 5-year-old girl came to the emergency room at K.R.M.T Wongsonegoro Hospital on August 10 2023, at 18.00 WIB with the main complaint of fever three days prior. The fever remained constant, decreased with paracetamol, and then returned (Chiumello, Gotti, & Vergani, 2017). Fever complaints coupled with weakness, poor appetite, and difficulty swallowing. The patient's family said the patient's tonsils were enlarged (Hanege, Acar, Tekin, Ozkanli, & Saygi, 2016). On physical examination, the patient had compost mentis, body temperature of 40.2 degrees Celsius, pulse 143 times per minute, breathing 20 times per minute, SpO2 98%, body weight of 16 kg, tonsils T3-T3 and there was detritus (Figure 1). The patient was consulted to a pediatrician with a diagnosis of chronic tonsillitis, acute exacerbation and suspected cause of diphtheria and received advice on Ringer Lactate infusion 12 drops per minute, Dexamethasone injection 1/2 ampoule three times a day, Cefotaxime injection 400mg three times a day, Paracetamol plus 175mg three times a day, Paracetamol suppository 125mg extra in the emergency room, Combivent (Ipratropium Bromide and Albuterol) and Flixotide (Fluticasone) 1 :1, Ambroxol syrup 1 teaspoon if necessary. The patient is scheduled to have a complete blood count, current blood sugar, electrolytes, chest X-ray in anteroposterior/lateral position, throat swab and tissue culture the next day, and then transferred to the isolation ward. Laboratory examination results with Calcium: 1.18 mmol/L, Current Blood Glucose: 69 mg/dL, Hemoglobin: 10.0 g/dL, Hematocrit: 30.50 %, Potassium: 5.00 mmol/L, Sodium: 130.0 mmol/L, Platelet Count: 269/uL, Erythrocyte Count: 3.72/uL, Leukocyte Count: 17.5/uL. The anteroposterior/Lateral chest x-ray examination showed a picture of bronchopneumonia. A throat swab showed positive results for Corynebacterium diphtheria bacteria.

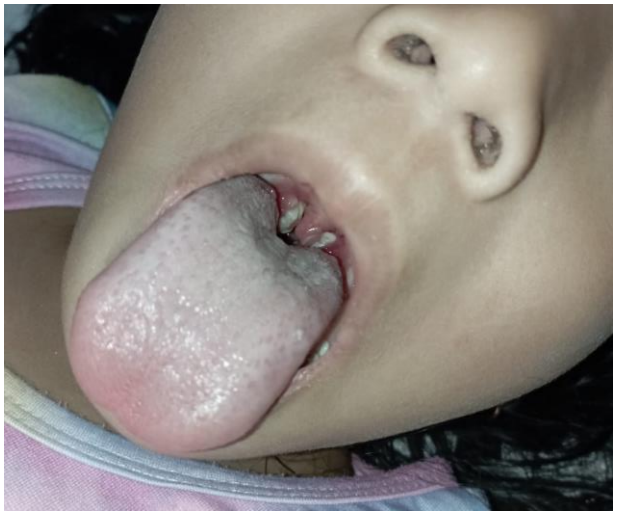

**Figure 1.** Visible Detritus and Pseudomembranes

## RESULT AND DISCUSSION

Diphtheria is an acute disease caused by Corynebacterium diphtheria, a gram-positive facultative anaerobic bacterium (Daniels & Sykes, 2021b). This disease is characterized by sore throat, fever, and

malaise. On examination, pseudomembranes are found in the tonsils, pharynx, and/or nasal cavity, so it can cause a bull neck. Depending on various factors, the manifestation of this disease can vary from asymptomatic to severe and fatal (Lai et al., 2020). The primary factors are host immunity, virulence and toxigenicity of C. diphtheriae (the ability of the germ to form toxins) and the anatomical location of the disease. Diphtheria has a germination period of 2-6 days.

Symptoms of tonsillar-pharyngeal diphtheria are anorexia, malaise, mild fever, and painful swallowing (Lopez & Martinson, 2017). Within 1-2 days, a membrane that bleeds easily adheres and is white-grey in colour and can cover the tonsils and pharyngeal wall, extending to the uvula and soft palate or down to the larynx and trachea. Cervical and submandibular lymphadenitis can occur if the lymphadenitis occurs together with extensive soft tissue edema of the neck resulting in a bullneck (Jayaram & Marnane, 2018). Furthermore, symptoms depend on the degree of penetration of the toxin and the area of the membrane. In severe cases, respiratory and circulatory failure can occur, as well as both unilateral and bilateral soft palate paralysis, accompanied by difficulty swallowing and regurgitation (Pfleger & Eber, 2016). Stupor, coma, and death can occur within 1 week to 10 days. In moderate cases, healing occurs gradually and may be complicated by myocarditis or neuritis. In mild cases, the membrane will fall off in 7-10 days, and complete healing usually occurs. Pseudomembranes were discovered in this patient; nonetheless, a physical examination revealed no bull neck look, and the patient also experienced dyspnea and breathing difficulties (Barrs & Dear, 2021).

The diagnosis of diphtheria is made based on clinical and laboratory examination. Diphtheria germs found by direct Gram staining are less reliable (Shah & Karanje, 2023). A more accurate way is identification using the fluorescent antibody technique, but this requires an expert. Definitive diagnosis is by isolating C. diphtheriae by culturing on Loeffler's medium or with the new Amies and Stewart medium, followed by in vivo (guinea pig) and in vitro (Elek's test) toxigenicity tests.

Suspected cases of diphtheria are people with symptoms of laryngitis, nasopharyngitis or tonsillitis plus greyish white pseudomembranes that do not come off easily and bleed easily in the pharynx, larynx, and tonsils (Organization, 2021). Probable cases of diphtheria are suspected diphtheria plus one of a) had contact with the case (<2 weeks), b) came from a diphtheria endemic area, c) Stridor, bull neck, submucosal bleeding or petechiae on the skin, d) heart failure, kidney failure acute, myocarditis and motor paralysis 1 to 6 weeks after onset, e) death. Confirmed cases of diphtheria are probable cases whose isolation results are positive for toxigenic C. diphtheriae (from swabs of the nose, throat, skin ulcers, tissue, conjunctiva, ear, vagina) or serum antitoxin increases 4-fold or more (only if both serum samples were obtained before administration of diphtheria toxoid or antitoxin). Meanwhile, carrier cases are people who do not show clinical symptoms, but laboratory examination results show positive for C. diphtheriae.

Diphtheria complications can occur because of local inflammation or due to exotoxin activity (Samdani, Jain, Meena, & Meena, 2018). Diphtheria complications can be grouped into airway obstruction and the impact of exotoxins, especially on the heart muscle, nerves, and kidneys, as well as secondary infections by other bacteria as follows:

1. Airway obstruction

   Caused by obstruction of the airway by the diphtheria membrane or by edema in the tonsils, pharynx, submandibular and cervical areas (Pikul, Syzova, Il'chenko, & Zvyagolska, 2021).
2. Impact of toxins

   The impact of the toxin can manifest in the heart in the form of myocarditis, which can occur in both mild and severe diphtheria and usually occurs in patients who are late in receiving antitoxin treatment (S.S. et al., 2024). In general, it becomes more difficult or later in the 2nd week, but can be earlier in the first week or later in the 6th week. Manifestations of myocarditis can include tachycardia, dull heart sounds, heart murmurs, or arrhythmia. Heart failure can also occur. Electrocardiogram examination abnormalities can include ST-segment elevation, PR interval prolongation, and heart block (Xue et al., 2020).

In this case, the patient was diagnosed with diphtheria tonsillitis with respiratory obstruction using Jackson's first-degree criteria, namely mild suprasternal retraction and no signs of fear.

The aim of treatment for diphtheria patients is to inactivate unbound toxins as quickly as possible, prevent and ensure that complications occur at a minimum, and eliminate C (Jong & Stevens, 2021). diphtheriae to prevent transmission and treat accompanying infections and complications of diphtheria. General management in cases of diphtheria consists of isolation until the acute period has passed and throat swab cultures are negative twice in a row. In general, patients remain isolated for 2-3 weeks. Rest in bed for approximately 2-3 weeks, and provide adequate fluids and a proper diet. Especially for laryngeal diphtheria, breathing remains free, and the air humidity is maintained by using a humidifier.

In special management, patients are given diphtheria anti-toxin (DAT). Antitoxin must be given immediately after a diagnosis of diphtheria is made. With antitoxin given on the first day, the death rate in sufferers is less than 1%. However, delaying more than the 6th day causes the death rate to increase to 30%. Before administering DAT, a skin test or eye test must be carried out first. When administering DAT, an anaphylactic reaction can occur, so a 1:1000 adrenaline solution must be provided in a syringe. The skin test was carried out by intracutaneous injection of 0.1 mL of DAT in a 1:1000 physiological saline solution. Positive results if within 20 minutes there is induration > 10 mm. The eye test is performed by instilling 1 drop of a 1:10 serum solution in physiological saline. In the other eye, physiological saline is instilled. Positive results if, within 20 minutes, symptoms of hyperemia in the bulbar conjunctiva and lacrimation appear. If the skin or eye test is positive, DAT is given by desensitization (Besredka). If the hypersensitivity test above is negative, DAT must be given simultaneously intravenously (Sevuk Ozumut & Turhan, 2024). The DAT dose is determined empirically based on the severity of the disease and duration of illness, not depending on the patient's body weight. Intravenous administration of DAT in physiological saline or 100 ml of 5% glucose over 1-2 hours. Observation of possible side effects of the drug/adverse reactions is carried out during antitoxin administration and during the following 2 hours. Likewise, it is necessary to monitor for the occurrence of delayed hypersensitivity reactions (serum sickness) (Eigentler et al., 2016).

Antibiotics are given to kill bacteria and stop toxin production. Treatment for diphtheria uses erythromycin (40-50 mg/kg/day, divided dose every 6 hours PO or IV, maximum 2 grams per day), Oral Penicillin V 125-250 mg, 4 times a day, aqueous crystals of Penicillin G (100,000 – 150,000 U/kg/day, divided dose every 6 hours IV or IM), or Penicillin procaine (25,000-50,000 IU/kg/day, divided dose every 12 hours IM). Therapy is given for 14 days. Some patients with cutaneous diphtheria recover with 7-10 days of therapy. Elimination of bacteria must be proven by at least 2 negative cultures from the nose and throat (or skin) taken 24 hours after completion of therapy. Therapy with erythromycin is repeated if culture results show C. diphtheriae.

**Table 1.**
**DAT Dose According to Membrane Location and Duration of Illness**

| Diphtheria Type | DAT Dose | Method |
|---|---|---|
| Nasal Diphtheria | 20.000 | Intramuscular |
| Tonsillar Diphtheria | 40.000 | Intramuscular or Intravenous |
| Pharyngeal Diphtheria | 40.000 | Intramuscular or Intravenous |
| Laryngeal Diphtheria | 40.000 | Intramuscular or Intravenous |
| Combination of the location above | 80.000 | Intravenous |
| Diphtheria + complication, bullneck | 80.000 – 120.000 | Intravenous |
| Late treatment (>72 hours), location anywhere | 80.000 – 120.000 | Intravenous |

**Table 2.**
**Treatment of Contact Diphtheria**

| Culture | *Schick Test* | Action |
|---|---|---|
| (-) | (-) | Isolation free: children who have received basic immunization are given a diphtheria toxoid booster |
| (+) | (-) | Carrier treatment: Penicillin 100 mg/kg/day orally/injected, or Erythromycin 40 mg/kg/day for 1 week |
| (+) | (+) | Penicillin 100 mg/kg/day oral/injection, or Erythromycin 40 mg/kg + DAT 20,000 Diphtheria toxoid (active immunization), according to immunization status |
| (-) | (+) | Diphtheria toxoid (active immunization), adjust according to immunization status |

a) Upper airway obstruction (may or may not be accompanied by bullneck)
b) If there is a complication of myocarditis, Prednisone 2 mg/kg/day for 2 weeks then reduce the dose gradually

The treatment for this patient was given nebulization Combivent (Ipratropium Bromide and Albuterol) and Pulmicort (Budesonide) 1:1 every 8 hours, Ringer lactate infusion 3cc/kg/hour, Diphtheria anti-toxin serum 40,000 IU intravenously, Procaine Penicillin at a dose of 800,000 IU given intramuscularly in the right and left gluteus muscle area alternately for 10 days, Ranitidine injection 1/2 amp two times a day, antibiotic Cefotaxime replaced with Azithromycin 150 mg peroral once a day for 5 days, Paracetamol ½ teaspoon two times a day, Paracetamol suppository 200mg if fever, Dexamethasone replaced with Methylprednisolone 25mg three times a day, as well as Ambroxol 8 mg, Cetirizine 1/2 tablet, Alerfed (Pseudoephedrine and Triprolidine) 1/3 tablet, Salbutamol 1.5 grams made into 12 powders three times a day. Before entering Diphtheria anti-toxin serum and Antibiotics, the patient had a skin test with negative results.

A number of factors affect the prognosis of diphtheria, such as the high fatality rates seen in children under five and in adults over 40, cases with an onset period longer than four days had a higher death rate, heart-related problems, specifically atrioventricular and left bundle-branch blockages are linked to a dismal outcome, following that, there is a strong correlation between systemic involvement and high death rates. The two main complications of diphtheria generally involve myocarditis and neuritis (Sanghi, 2014). Mortality results in five to ten per cent of cases. Pseudomembrane formation in the upper respiratory tract might result in respiratory obstruction, which calls for immediate mechanical ventilation and intubation, leading to another serious complication (Balfour-Lynn & Wright, 2019). The patient initially reported having dyspnea during the hospital stay however nebulization and oxygenation therapy resolved (DiNino et al., 2016).

Myocarditis caused by first-, second-, or third-degree heart block, which frequently results in circulatory collapse, can be a symptom of diphtheria (Van Damme et al., 2018). Neural problems associated with diphtheria include nerve weakness or paralysis, especially when it comes to the cranial

nerves and the nerves in the extremities, which can result in muscle weakness in the limbs. The soft palate and pharyngeal muscles may be involved in regurgitating food and liquids through the nose. Although rare, children can develop encephalitis as a result of complications from diphtheria (Perry, 2021).

Overall, the patient's diphtheria treatment is continued until the patient is discharged from the hospital and her condition shows improvement (Jain, Samdani, Meena, & Sharma, 2016). Keeping things clean and educating kids about the risks of diphtheria are two aspects of general prevention. Immunization is required because, generally speaking, children who have had diphtheria develop very little immunity to the illness. The usual methods of prevention include carrier treatment and the Diphtheria Pertussis Tetanus (DPT) vaccination (Prygiel, Mosiej, Gorska, & Zasada, 2022).

The newborn develops passive immunity from transplacental maternal antibodies throughout the first few months of life (Albrecht et al., 2022). After receiving a diphtheria toxoid vaccination and experiencing an actual active infection, one can develop active immunity. Although basic immunization for this patient is known to be completed, repeat immunization is crucial to ensure that five immunizations are administered before the patient becomes six years old, and DPT is still highly critical to maintaining antibody levels above the preventive threshold. The Moloney and Schick tests can be used to determine a person's immunity to diphtheria.

The mainstay of the fight against diphtheria is vaccination.11 The main DPT vaccination will be administered to you three times, at intervals of 4-6 weeks, if you have never gotten it before. Complete the immunization right away if it hasn't been provided yet—there's no need to repeat it. Additionally, those who have had their initial vaccination (less than a year) must get a DPT immunization again when they are five years old and eighteen months old.

## CONCLUSION

Diphtheria, an acute disease caused by the gram-positive facultative anaerobic bacterium Corynebacterium diphtheriae, requires prompt diagnosis, appropriate management, and careful monitoring to minimize complications and improve patient outcomes. Continued research is essential to better understand the complications associated with diphtheria and its treatment.

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