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Case Report

# A Patient with Suspected Diphtheria

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***ABSTRACT***

*It was reported that a mature woman, Mrs. S, 42 years old with several complaints and symptoms such as fever, swallowing pain weak body, swollen tonsil with beslag, dirty uvula of mouth cavity and tongue, and bullneck. The final diagnosis indicated that the patient was suspected diphtheria, candidiasis oris, sepsis, and pneumonia. The sudden death of the patient was probably caused by myocarditis.*

**Keywords:** *myocarditis, diphtheria, sepsis*

## INTRODUCTION

Diphtheria has been a nightmare for thousand years hunting human life and health. It was firstly found in Hippocrates era when the first epidemic occurred in the 6th century B.C. (Nandi *et al*, 2003). This disease is still endemic in many developing countries in Africa, Asia, and South America (Shah, 2005). The change of diphtheria epidemiology happens in the entire part of the world. The proportion of adults who are susceptible to diphtheria is mostly discovered in many developing and developed countries (Mattos *et al.*, 2003). It was reported that there were 39 cases in East Java Province in 2006 including 8 cases in Surabaya, 7 cases in Kabupaten Sidoarjo, 4 cases in Kabupaten, Sumenep, and 4 cases in Probolinggo (Health Department East Java, 2006).

This classic disease caused by gram-positive bacillus called *Corynebacterium diphteriae* which usually occurs in the upper respiratory tract. It is indicated by the formation of pseudomembrane in the infected place followed by the general symptoms caused by exotoxin produced by the bacillus (Acang, 2006).

The emergence of immunization program caused relatively low cases of diphtheria as a contagious disease (Health Department East Java, 2006). The progress of the disease is very fast. Therefore, the high level of suspicion towards the disease is important to be maintained (Mattos *et al.*, 2003). In an acute state, it has case-fatality ratio > 20% if there is no sufficient diagnostic procedure and therapy option. However, the ratio can decrease up to 3% if there is an antitoxin (Volzke, 2006). Because the disease rarely occurs, many doctors also rarely face the diphtheria case. Therefore, it might cause diagnosis failure through clinical examination. Not all laboratories regularly perform throat swab culture for *C. diphtheriae*. It probably increases the case of wrong diagnosis or late diagnosis for diphtheria (Bonnet, 1999). If we are late to diagnose and cure the disease, it can increase the probability of death rate up to 20 times higher than its normal death rate. The most dominant factor causing death is myocarditis (Acang, 2006). Myocarditis diphtheria incidences related to nasopharyngeal diphtheria were 10-20% with death rate up to 50%–60% (Kneen *et al.,* 1998; Dung *et al*., 2002).

In this case, a patient was reported with suspected diphtheria. She died and it was probably caused by myocarditis. This study focused on its diagnostic problems and management.

## CASE

A woman, Mrs. S, 42 years old, a Moslem, a Javanese, an office girl in a factory in Manukan Tandes Surabaya, living in Bongso Wetan Pengalangan Menganti Gresik, came to RSUD Dr. Soetomo through ICU (Intensive Care Unit) in April 29, 2009. The major symptom, problem, or complaint was fever or high body temperature.

She had experienced the fever since 9 days before she was hospitalized. Her body also shook when she got the fever. Analgesic medication gave some relief to the

fever then she started to sweat only for a moment and the temperature rose again. She also complained about high body temperature together with sore throat like a misnomer. And she had nausea without vomiting and her body was felt so weak. Since 4 days before hospitalized, she didn't want to eat because of pain when she widely opened her mouth and tried to swallow. It was accompanied by white spots which looked dirty in her mouth cavity since 3 days before hospitalized. In addition, one day before hospitalized, her neck was getting bigger like a mumps. There was no cold/flu, cough, dyspnoea, or husky voice, while excrement and urination were normal.

From the immunization record, the patient was not sure whether she had been immunized before. She also stated that she used dentures since a month before she was hospitalized. Either her family living in the same house with the patient or her neighbors never experienced an illness like her before. In addition, the patient lived near prostitution area.

Previously, she was a patient in Bhakti Rahayu Hospital suspected diphtheria and hospitalized there for 7 days with therapies as follows: Ciprofloxacin infusion 400 mg/12 hours, Metoclopramide, Paracetamol tablets 3X500 mg. She brought the examination result of diphtheria sample. From the throat swab analysis, granular bacilli were found and through the examination of spore sample, yeast cells were discovered.

**Physical examination in April 29, 2009 (at night)**

The general condition of the patient was weak, blood pressure 120/80 mmHg, pulse rate 90 BPM regular, respiratory rate 22/60 Hz, axillary temperature 36.8° C (after paracetamol intake). Through head and neck examinations, there was no pale conjunctiva, icterus, cyanosis, dyspnoea, respiratory stidor, or rhinorrhea from nose. There was a lymph node in neck with the appearance of bullneck. Through the examination of mouth cavity, it was found that both tonsils were swelling and looked dirty (beslag/membrane+) it also occurred in uvula, mouth cavity, and tongue. From the chest examination, it indicated that there was no movement from auxiliary breathing muscle; the first and the second heart beats were sole and regular; there was no murmur, gallop sound, or extrasistole; and there was no ronchi or wheezing. Abnormality was not found in stomach or gastro-intestinal system examination. Through extremity test, there was no edema or wound with normal physiology reflect.

**Laboratory examination in April 29, 2009**

Blood test showed these following information: Hemoglobin 11.6 g/dL, leukocyte 4.100/$mm^3$, glucose 121 mg/dL, creatinine serum 0.5 mg/dL, BUN (Blood Urea Nitrogen) 7.9 mg/dL, SGOT (Serum Glutamic-Oxaloacetic Transaminase) 29 IU/L, Albumin 3.1 g/dL. Blood gas analysis revealed these data: pH 7.54, $pCO_2$ 29 mmHg, $HCO_3^-$ 24.8 mmol/L, BE 2.3 mmol/L, SO2 97%.

**Supporting or Additional Examination April 29, 2009**

Chest X-ray : normal heart and lungs
Electrocardiography : Sinus rhythm 100 beats/minute with normal axis

**Diagnosis** : Suspected faucial diphtheria with candidiasis oris + sepsis.
To support the diagnosis, throat and nose swabs were performed and the patient was taken into an isolated room.

**Therapy** : $O_2$ nasal 3–4 lpm, Tutofusin infusion: RD5: PZ (21 drops/minute), High Calorie and High Protein diet through sonde 6×150 cc, Anti-Diphtheria Serum 40.000 units, PPC (Phosphatidylcholine) injection 2×600.000 IU/IM, Nystatin drop, and Paracetamol 3×1.

**Monitoring** : vital signs, airway obstruction

**CASE HISTORY**

**Treatment Day 1**

S: fever, sore throat, pain in swallowing, difficulty in eating, slight drinking, nausea without vomiting
O: General condition was weak with GCS 456, blood pressure 110/70 mmHg, pulse rate 88 BPM, RR 22/60 Hz, axillary temperature 38° C.
Head: no anemia, icterus, cyanosis, dyspnoea
Swelling tonsil with beslag, dirty mole on uvula-palate of the tongue
Thorax: symmetric without retraction of respiratory muscle
Cor: S1 S2 sole, without murmur
Pulmo: without wheezing or ronchi
Abdomen: intestinal noise +, liver and lien were not palpable
Extremity: warm acral without edema
Complete urine test: protein +1, epitel cell 6–8
The result of the second throat swab: bacillus gram negative, yeast
A: suspected faucial+candidiasis oris+sepsis
P: Tutofusin injection RD5: PZ (21 drops/minute), sonde diet High Calorie High Protein 6×150 cc, PPC 2×600.000 iu/im, ranitidine injection 2×1 amp iv, ketoconazole 2×1, nystatin drop, and paracetamol 3×1

**Treatment Day 2**

S: fever, sore throat, pain in swallowing, slightly eating, finish the milk, sometimes nausea
O: General condition was weak with GCS 456, blood pressure 100/80 mmHg, pulse rate 90 BPM regular, RR 20/60 Hz, axillary temperature 38° C.
Head/Neck: no anemia, icterus, cyanosis, dyspnoea

Swelling tonsil with beslag, dirty mole on uvula-palate of the tongue still appears
Thorax: symmetric without retraction of respiratory muscle
Cor: S1 S2 sole, without murmur
Pulmo: without wheezing or ronchi
Abdomen: no abnormality
Extremity: warm acral without edema
The result of throat swab: bacillus gram negative

A: suspected diphtheria, candidiasis oris+sepsis
P: Tutofusin injection RD5:PZ (21 drops/minute), sonde diet porridge, PPC 2×600.000 iu/im, Ketoconazole 2×1, Nystatin drop, and Paracetamol 3×1

**Treatment Day 5**

S: fever, less sore throat, eat more porridge, no nausea and vomiting
O: General condition was weak with GCS 456, blood pressure 110/70 mmHg, pulse rate 100 BPM regular, RR 22/60 Hz, axillary temperature 38° C.
Head/Neck: no anemia, icterus, cyanosis, dyspnoea
Less swelling tonsil with beslag, dirty mole on uvula-palate of the tongue started to be
Thorax: symmetric without retraction of respiratory muscle
Cor: S1 S2 sole, without murmur
Pulmo: without wheezing or ronchi
Abdomen: no abnormality
Extremity: warm acral without edema
VCT result: HIV antibody non reactive
A: suspected diphtheria, faucial+candidiasis oris+sepsis
P: Tutofusin injection RD5:PZ (21 drops/minute), sonde diet porridge, PPC 2×600.000 iu/im, ketoconazole 2×1, nystatin drop, and paracetamol 3×1

**Treatment Day 6**

S: fever, no appetite, less pain in swallowing, cough with phlegm, no nausea, vomiting, or dyspnoea
O: General condition was weak with GCS 456, blood pressure 120/70 mmHg, pulse rate 96 BPM regular, RR 22/60 Hz, axillary temperature 39° C.
Head/Neck: no anemia, icterus, cyanosis, dyspnoea
Less swelling tonsil with beslag, dirty mole on uvula-palate of the tongue started to clean
Thorax: symmetric without retraction of respiratory muscle
Cor: S1 S2 sole, without murmur
Pulmo: without wheezing or ronchi
Abdomen: no abnormality
Extremity: warm acral without edema
The result of throat swab: bacillus gram negative
A: suspected diphtheria, faucial+candidiasis oris+suspected pneumonia+sepsis
P: Tutofusin injection RD5:PZ (21 drops/minute), sonde diet porridge, PPC 2×600.000 iu/im, Cefriaxone 2 gr 1×1 iv, Ketoconazole 2×1, Nystatin drop, & Paracetamol 3×1
Examination suggestion: a plan for lungs consultation based on the suspected pneumonia was postponed waiting the result of the second thorax Rontgen (cito).

**Treatment Day 7**

S: still fever and cough with phlegm, the patient didn't want to eat even the swallowing pain decreased, no nausea, vomiting, or dyspnoea
O: General condition was weak with GCS 456, blood pressure 120/70 mmHg, pulse rate 106 BPM regular, RR 24/60 Hz, axillary temperature 38.5° C.
Head/Neck: no anemia, icterus, cyanosis, dyspnoea, there was tachypnea
Less swelling tonsil with beslag, dirty mole on uvula-palate of the tongue started to clean
Thorax: symmetric without retraction of respiratory muscle
Cor: S1 S2 sole, without murmur
Pulmo: without wheezing or ronchi
Abdomen: no abnormality
Extremity: warm acral without edema
A: suspected diphtheria, faucial+candidiasis oris+suspected pneumonia+sepsis
P: O2 nasal 3–4 lpm, tutofusin injection RD5:PZ (21 drops/minute), sonde diet porridge, PPC 2×600.000 iu/im, cefriaxone 2 gr 1×1 iv, ketoconazole 2×1, nystatin drop, and paracetamol 3×1

Examination suggestion: blood culture, thorax Rontgen cito (delayed).

**At 2 p.m. in the 7$^{th}$ day of treatment**

It was reported that suddenly the patient had apneusis. When the pupils was checked, it had been mydriasis. Previously, based on the family statements, she had just finished the meal and she was able to eat half portion of the meal. She asked for a meal because she felt uncomfortable in liver area and felt cold in her body. After finishing the meal, the patient's family went out from the isolation room for about 15 minutes to wash their hand in the bathroom. However, when they came back to the room, the patient didn't breathe anymore.

**Final diagnosis:** suspected diphtheria, faucial+candidiasis oris+suspected pneumonia+sepsis+suspected myocarditis

**The result of throat and nose swabs proliferation:** before finished the therapy in May 8, 2009 no development of *Corynebacterium diphtheria.*

**The result of blood culture:** finished in May 12, 2009, it was found *Escheria coli* (ESBL+) without the development of anaerobe microbes.

## ANALYSIS

Diphtheria is an acute infection in mucosa of respiratory tracks (tonsil, pharynx, larynx, or nose) sometimes it appears on skin but rarely occurs in other mucosa such as eye, ear, and genital. Diphtheria is caused by gram-negative

bacillus which is aerobe, no capsule, non-motile, no spore, and produces exotoxin (White, 2003; Tiwari, 2008). Human is the only reservoir of diphtheria infection (Lumio, 2003). The spreading of the disease is through direct contact from respiratory liquid droplet (cough, sneeze, and talk), exudates of patient's skin lesion or diphtheria carrier, or through indirect contact with contaminated dust, cloth, book, or toy (Shah, 2005; Acang, 2006).

Before the development of immunization program, diphtheria was a childhood disease. Since 1980, the immunization program had increased the probability of the infection in adults (Acang, 2006). Because the incidence of diphtheria was rare, the exposure to the bacteria causing the disease was not a common thing to do as well as its repeated exposure. If adult people had not been exposed naturally with diphtheria or administered booster dosage of toxoid diphtheria, the immunity gained in the childhood will decrease in the manhood. Therefore, adults are susceptible to diphtheria (Nandi *et al.*, 2003). Antibody level towards diphtheria is considered protective, if the level š 0.1 IU/ml (full protection) (Prosppero *et al.*, 1997; Tiwari, 2008). The immunity of the half recovered patients of diphtheria was not adequately developed. Therefore, immunization is still needed to be given after the patients recover from diphtheria (Prosppero *et al.*, 1997; Shah, 2005). The result of a research in Turkey stated that the protection upon diphtheria starts to decrease after the age of 30 and achieves its lowest level in the age of 40–49 (Cavus *et al,* 2007). In developing countries where diphtheria is still endemic, the disease characteristics indicate that it has high fatality level, numerous complications, and mostly attacks young people or adults (Mattos *et al,* 2003). Some studies proofed that women has higher risk towards the diphtheria infection because they have lower immunity level than men. Therefore, women are more likely to be attacked by diphtheria (Acang, 2006).

The patient was a woman aged 42 years old, born in 1967. The immunization program had just established in 1980. Therefore, probably the patient had not been administered by diphtheria immunization. Even if she had been infected before, the immunity formed was not adequate to protect her from the second attack of the disease.

The diagnosis of diphtheria is based on signs and clinical symptoms supported by laboratory data, test, or confirmation (Bishai, 2008). Clinical suspicion with a high index is the key of the diagnosis, therefore, antitoxin treatment can be immediately administered (Lakkireddy, 2005). Diphtheria is not easily and clinically diagnosed. Mild cases such as pharyngitis streptococcal and classical form of diphtheria with pseudomembrane in pharynx might not develop, especially in person who had been given an immunization (Bonnet, 1999). In one side infection of tonsil, the appearance of edema is often misinterpreted with peritonsillar abscess which tonsillectomy is not necessary to be performed (Lumio, 2003).

The characteristic of diphtheria pathology because of destructive effect of toxin in epitel cell is the existence of imperfect membrane (patchy) then it becomes thick in the following days called pseudomembrane (Lumio, 2003; Bishai, 2008). The diagnosis of diphtheria is should not be based on the appearance of pseudomembrane. Many studies stated that pseudomembrane was not found in diphtheria patients for about 1/4–3/4 of the entire observed cases. It might never appear any membrane or it has gone in the beginning of the disease attack. Although it not always appears, it has a special thick form and following substances: fibrin, broken epitel cell, bacteria, polymorphonuclear cell, grey or white in color and very sticky, if we try to get rid of it, it will leave a wound with bleeding surface (Bonet, 1999; Lumio, 2003).

For clinical purpose, it will be much easier to classify this disease based on the location of lesion anatomy. The classifications of the locations are nasal, faucial (tonsil and pharynx), laryngeal or laryngotracheal, and non-respiratory: cutaneous, conjunctiva, and genital (Lumio, 2003; White, 2003). Diphtheria occurs after *C. Diphtheriae* enters nose or mouth with incubation period around 2-5 days or even 10 days after the infection (Lumio, 2003; Bishai, 2008). Unspecific complaints or symptoms will occur such as sore throat and fever sometimes with shiver, great pain and difficulty in swallowing food, nausea, vomiting, and headache as a part of faucial diphtheria (Lumio, 2003). Pseudomembrane initially formed in the tonsil might dilate to uvula, platum mole, oropharynx, nasopharynx, or larynx accompanied by lymph node, pain and oedema called bullneck. Nasal diphtheria is usually mild and chronic characterized by nasal discharge which is usually clear or serous then it becomes serosanguineous and bleeding both unilateral and bilateral. Larynx diphtheria is characterized by husky voice which gradually becomes heavier and stidor followed by breathe difficulty as the extension of faucial diphtheria. We can see indirectly the swollen epiglottis and subglottis with pseudomembrane through laryngoscopy. Cutaneous diphtheria usually appears in foot in a form of pustule or vesicle to chronic ulcer with dirty grey membrane (Bonnet, 1999; Lumio, 2003; White, 2003). Malignant diphtheria has more acute onset. The patients will easily become toxic, high fever, fast pulse, hypotension, and cyanosis. Pseudomembrane widens fast together with bullneck state (White, 2003).

The patient was diagnosed as suspected faucial diphtheria based on signs and clinical symptoms obtained from anamnesis such as high body temperature, sometimes with shiver followed by sore throat, then continued with difficulty in swallowing food, nausea, vomiting, weak body, swollen neck similar to goiter, and dirty state of mouth cavity. The physical examination showed axial temperature ≥38° C, beslag in both tonsils with inflammation which is uncommon for diphtheria. Uvula, palatum mole, and tongue looked dirty and there was a bullneck.

Laboratory diagnosis is used to confirm the infection and used as a supporting data not a replacement for clinical diagnosis (Lumio, 2003). One of presumptive diagnosis which can be performed is the use of gram coloring

(Acang, 2006). Although *C. diphtheriae* is described as a positive-gram bacterium, it is easily faded during the coloring procedure and it might appear as negative-gram bacterium (White, 2003). Definite diagnose is obtained and based on the discovery of *C. diphtheria* through cultural examination in selective media such as Loffler, tellurite media, and tinsdale agar taken from throat and nose swabs. It is suggested that it is better to take the substances from the membrane or lower membrane if there is any (Efstratiou, 1999). This examination is performed before and after the treatment (Acang, 2006). However, the culture is often negative (40% cases) or other organism grow in it. The negative culture is especially resulted after the patient consumes antibiotic before coming to the hospital (White, 2003; Lakkireddy, 2005). The treatment or cure using antibiotic causes 84%-96% patients showing negative result in the day 2–3 (Lumio, 2003). If the result of the culture of the patient suspected diphtheria is negative, isolation of the bacteria from close contact is important to support the diagnosis confirmation (Efstratiou, 1999).

Another test to diagnose the existence of diphtheria microbe is by detecting the presence or the absence of toxin through *Elek plate test* (Acang, 2006) but this examination is often misinterpreted. Other different method is Polymerase Chain Reaction (PCR) which is simple and fast (5-6 hours) (Lumio, 2003). PCR is used to detect gene organizing the production of toxin (dtxR) and dyptheria toxin gene (tox) in a state where diphtheria bacterium organism is not found in culture when antibiotic has been given (Tiwari, 2008).

The patient brought the result of laboratory examination of throat swab with a negative result. However, the re-examination using gram coloring in RS Dr. Soetomo indicated that negative-gram bacilli were found with negative diphtheria in culture examination result. The treatment history of the patient was that during her treatment in RS. Bhakti Rahayu, she had been administered drip antibiotic ciprofloxacin 2×500mg. This condition was similar to several cases in other countries when there were negative results in both throat swab culture and pseudomembrane sample, while the PCR result of diphtheria was positive (Lurie *et al*., 2004). The difference was that Mrs. S did not perform the PCR examination. Therefore, until her death, she was considered as patient with suspected diphtheria case.

Other laboratory examinations usually performed for diphtheria are complete blood examination and urinalysis. Patients often show the moderate increasing of leukocyte and mild proteinuria (1+ to 2+) might also be found (Frasseto, 2008).

The result of complete blood examination tended to show leucopenia. It might be caused by sepsis from other infections. It was confirmed by the finding of e-coli (ESBL+) and after her death, yeast in throat swab was found. Sepsis was a clinical state related to infection with SIRS manifestations (body temperature >38° C or <36° C, heart frequency >20/60 Hz, respiratory frequency >20/60 Hz or $PaCO_2$ <32 mmHg, leucocytes >12.000/$mm^3$ or <40.000/$mm^3$ or bacilli >10%) (Chen, 2004). Other evidences which showed that the patient was in a sepsis state were heart frequency ever reached up to 100/60 Hz; body temperature was always >38° C; $PaCO_2$ 29 mmHg; average respiratory rate 22/60 Hz daily. Through urinalysis, it was found proteinuria +1.

As e-coli (ESBL+) found in the blood culture, it indicated that there was bacteria infection which produced ESBL (Extended Spectrum Beta Lactamase). The patient suffered from several infections such as urine tube infection, peritonitis, cholangitis, abscess intra abdominal, ventilator-associated pneumonia, and central-line associated bacteremia. There were several factors causing the infection and bacteria colony producing ESBL: 1. The installation of catheter (artery, central vein, urine tube, gastrostomy or jejunostomy tube, and umbilical catheters); 2. Surgery actions (abdominal and emergency laparotomy surgeries); 3. The use of antibiotics (Cephalosporin 3$^{rd}$ generation especially Ceftazidime, Fluoroquinolone, Trimethoprim-sulfamethoxazole); 4. Previous treatment in nursing home; and 5. The length of treatment in the hospital or ICU. *E.coli* producing ESBL is multiresistant so that it increased the tension of the disease (Wahjono, 2007).

The treatment of diphtheria is divided into two: general and specific or special treatment. The general treatments includes: 1. Isolation, 2. Bed rest at least 2–3 weeks, 3. Soft or liquid food depending on the state of the patient, 4. Cleanliness of respiratory track and liquid absorption, and 5. Electrocardiography control 2-3 times a week for 4-6 weeks to detect myocarditis earlier. The specific or special treatment aims to: 1. Neutralize toxin produced by diphtheria bacilli, and 2. Kill diphtheria bacilli producing toxin (Acang, 2006). From other source, it stated that the patient should be strictly monitored especially related to heart and respiratory functions. In the patient with a wide pseudomembrane, it is necessary to consult with Ear, Nose, and Throat (ENT) specialist or anesthetist. It is recommended for performing tracheostomy or intubation if it is possible (Bishai, 2008).

*C. Diphtheriae* is susceptible to antibiotics. Nowadays, penicillin and eritromicin are recommended by WHO (World Health Organization) to cure diphtheria (Kneen *et al,* 1998). Antibiotics are administered to the patients until they are able to swallow without feeling pain. Procaine Penicillin G with dosage of 600.000 unit i.m. is given every 12 hours then followed by peroral drug 500mg every 6 hours up to 14 days until they can swallow (Bishai, 2008). The dosage of antibiotics given is based on the location of primary infection, the dilatation of pseudomembrane, and the duration between onset and the intake of antitoxin: 20.000–40.000 units for faucial or cutaneous diphtheria which is less than 48 hours, 40.000–80.000 for faucial or laryngeal diphtheria which the onset is more than 48 hours, and 80.000–100.000 units for malignant diphtheria (White, 2003).

Generally, the treatment given to the patient was appropriate with the standard for diphtheria treatment, although the hospital was late to give antitoxin. Diphtheria antitoxin was given in the day 4 after the appearances of clinical signs and symptoms with minimal dosage (40.000 units). Consultation with other division such as ENT division was not performed because the suspicion toward infection dilatation in larynx was not found when husky voice or stidor was not found in the patient. In addition, EKG monitoring was also skipped.

Complication is the major cause of diphtheria morbidity or mortality. Factors contributing the high mortality rate for diphtheria patients are inadequate immunization intake, low socio-economy standard, population density, lateness treatment, and the absence or lateness of antitoxin administration (Jayashree *et al.*, 2005).

Mechanic complication of diphtheria is caused by membrane, while the systemic effect is caused by toxin (Shah, 2005). Clinical intention should be focused on the obstruction of respiratory track, acute systemic toxicity, and myocarditis-neuritis mediated by the toxin (Mattos *et al.*, 2003). Pseudomembrane can lose or widen to larynx and tracheobronchial branch so it obstructs the respiratory track (Bishai, 2008). Mortality in diphtheria case was mostly caused by complications mediated by toxin of *C. Diphtheriae* which created wide damage (such as myocarditis or secondary respiratory failure resulted from peripheral neuropathy, larynx edema, kidney failure, disseminated intravascular coagulation) (Dung, 2002). Other diphtheria complications are pneumonia, embolic pulmonary, encephalitis, cerebral infarct, acute tubular necrosis (White, 2003; Bishai, 2008). Pneumonia sepsis or septicemia was also reported as diphtheria complication although the bacteria were rarely isolated from blood. Bad state or status of patient's immunology might be responsible for its manifestation (Barakett *et al.*, 1992).

The patients was suspected myocarditis complication and pneumonia, while the sepsis was caused by other secondary bacterial infections not from the suspected diphtheria, but from E-Coli (ESBL+) as shown in blood culture result. The risks of complications in this patient were the absence of immunization, low socio-economy standard (office girl), late administration of antitoxin (in the 4$^{th}$ day after clinical symptoms occurred) with minimal dosage.

Myocarditis is an inflammation disease in myocardium caused by either infection or non-infection. In the examination post-mortem of myocarditis, it was found 1–9% of myocarditis. Therefore, it was suspected as the cause of sudden death (Alwi *et al,* 2006). Heart damage or failure in diphtheria case is the major factor of mortality in adults (≥40 years old) (Lumio *et al.*, 2004; Nalmas *et al,* 2007). Myocarditis is often found in patients with inadequate immunization history and late administration of antitoxin (Jayashree *et al.*, 2006). Complication of heart increases 2–3 times in patients who receive antitoxin > 48 hours from the onset of the disease (White, 2003). Diphtheria myocarditis generally occurs in the first 2 weeks of illness (Bishai, 2008). The principles of its manifestation are cardiomyopathy dilatation, various types of disritmia and conduction problems. The effects can be asymptomatic and undetected if there is no routine hearth detection (Volzke, 2006). Sudden death might happen, although general description of heart failure is progressively unclear (Fine, 1950). Approximately, 50% of diphtheria myocarditis patients developed severe conduction problems related to the fatal outcome. It is because diphtheria toxic is irritable so that tachyarrhythmia might easily happen (Dung *et al*., 2002).

Electrocardiography is a noninvasive procedure and it has an important role in the measurement of disease severity in various infections. It also might indicate heart complication and give information about prognosis (Nalmas *et al.*, 2007). EKG can show myocarditis caused by acute infection when there is only a minimal clinical signs, unclear, or even no sign at all (Fine *et al.*, 1950). EKG abnormality was reported from 16.5%–84% diphtheria patients (Morgan, 1963). The change of T wave and heart block in the first degree could occur without any clinical sign and develop into severe heart block (Mattos, 2003). Conduction abnormality causing cardiogenic shock is the most manifestation happens in diphtheria case (Jayashree *et al.*, 2006).

In a research, to early detect myocarditis diphtheria indicated by lengthen QT interval which causes ventricular arrhythmia, EKG with 12 lead serial can be performed as alternate say in 1$^{st}$–10$^{th}$ day then continued given once a week after going out from the hospital (Kneen *et al.*, 1998). A strict EKG monitoring is an indication to detect heart problem caused by diphtheria toxic, especially in the first week of illness (White, 2003). It can be performed 2–3 times a week for 4–6 weeks to early detect myocarditis (Shah, 2005). Another monitoring to detect myocarditis is cardiac enzyme examination (Acang, 2006), in which there is an increase of cardiac enzyme level (White, 2003; Alwi *et al.*, 2006).

The risky factors which cause fatal diphtheria myocarditis in this patient were: age > 40 years old (without immunization history), administered by antitoxin > 48 hours after clinical diphtheria onset. She suddenly died in the day 7 of the treatment or in the second week since she complained about fever and sore throat in the previous hospital. The condition in 15 minutes before the death showed that she was in a good condition indicated from the appetite. She could eat the meal more than in the previous days. Vital signs recorded in the morning were still good even though the patient in febris and there was an increase of breath frequency. It was probably a myocarditis as a complication caused by diphtheria toxic in heart. Unfortunately, during the treatment in isolation room, she was not observed through strict EKG serial as an effort to early detect myocarditis in suspected diphtheria patient. The first EKG examination showed sinus rhythm 100/60 Hz with normal axis. Moreover, the physical observation of heart diagnostic was not maximal and there was no other

supporting examination for detecting myocarditis such as re-taking of thorax x-ray, cardiac enzyme, and previous echocardiography. It was also noted that the patient was an adult who epidemiology indicated to have higher risk of diphtheria. The outcome was fatal because it was supported by other mortality factor.

## SUMMARY AND CONCLUSION

From the description of this case, there are several suggestions given: 1. because the diphtheria toxic can attack many organs, strict observation is needed to control all of the symptoms which occur either from patient's complaints, physical examination, or other supporting information from the patient (Acang, 2006) especially to the one who receive late diagnosis of diphtheria; 2. Besides, consultation with other divisions is also needed related to the occurrence of complications (Bishai, 2008), so that the patient can be completely treated; 3. If the patient is suspected sepsis state, it is necessary to immediately identify the vector bacteria. Nasroudin stated that antibiotics can be administered in the first hour, if there's an indication, while antibiotic monotheraphy can be given if there is an infection without neutropenia. If there is neutropenia, the combination of antibiotics is needed. Definitive antibiotic is given based on reproduction result and sensitivity tests in the first 48–72 hours.

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