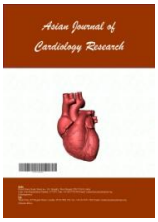

Asian Journal of Cardiology Research

4(2): 38-43, 2021; Article no.AJCR.66703

The Important Role of Temporary Pacemaker in the Complete Atrioventricular Block Due to Diphtheria

Lam Truong Hoai[1*], Toan Tran Ke[1], Luan Ha Quang[1] and Tra Le Pham[1]

[1]Department of Cardiovascular, Gia lai Province Hospital, Vietnam.

Authors' contributions

This work was carried out in collaboration among all authors. Author LTH designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors TTK and LHQ, TLP managed the analyses of the study. Authors LHQ, TLP managed the literature searches. All authors read and approved the final manuscript.

Article Information

Editor(s):
(1) Dr. Sam Said, Hospital Group Twenty, Netherlands.
(2) Dr. Farhad Ali, City University of Science and IT, Pakistan.
(3) Dr. Scicchitano Pietro, F. Perinei Hospital, Italy.
Reviewers:
(1) Alexandre Simões Dias, Universidade Federal do Rio Grande do Sul, Brazil.
(2) Carina Aparecida Marosti Dessotte, Universidade de São Paulo, Brazil.
Complete Peer review History: http://www.sdiarticle4.com/review-history/66703

Case Study

Received 08 February 2021
Accepted 13 April 2021
Published 17 April 2021

ABSTRACT

Diphtheria has still existed and highland Vietnam, where 49 cases suffered occur in 2020 in Gialai province with 2 cases of deaths. Infection with toxigenic Corynebacterium diphtheriae may result in widespread toxin-mediated damage, particularly in the kidneys, nervous system, and heart (i.e., diphtheritic myocarditis). Diphtheritic myocarditis occurs in 10–20% of patients who initially present with oropharyngitis. Overall, diphtheritic myocarditis has an associated mortality rate of~60%, and it accounts for the majority of deaths related to diphtheria. However, patients with myocarditis who survive appear to make a full recovery. A case of severe diphtheria complicated by myocarditis is reported in Gialai province. The myocarditis manifested with severe conduction disturbances including left bundle-branch block and atrioventricular block third degree. Antitoxin has proven its value in the early stages of the illness, but it has limited action against penetrating toxins or toxins already absorbed into the cell. Temporary transvenous electrical pacing for 5 weeks was successful in the management of this complication. This case illustrates the potential value of electrical pacing in diphtheritic myocarditis.

**Corresponding author: Email: truonglamcs@gmail.com;*

Keyword: Temporary pacemaker; diptheria; myocarditis; complete atrioventricular block.

1. INTRODUCTION

Diphtheria is an infectious, toxic, and serious clinical entity caused mainly by external toxins (The scientific name is Corynebacterium Diphtheriae), which has high mortality and complications. Although cases are no longer reported in developed countries due to the availability of preventive vaccines, cases are still reported in developing countries. The secreted toxin affects many organ systems such as the kidneys and nerves, in which cardiovascular damage plays a major role in death in the disease from 50-70% [1]. Cardiovascular manifestations include heart failure, bradycardia, tachycardia. The majority of cases present with bradycardia due to complete atrioventricular block and temporary pacemaker insertion. Thanks to the effectiveness of the vaccine to prevent disease, the disease is very rare today, but recently there have been reports of diphtheria and death due to its complications in both children and adults, especially in children.

On July 28, 2020, Gia Lai Provincial General Hospital received a toxic diphtheria patient with severe infectious complications causing severe conduction block, myocarditis, severe heart failure, and other complications neuromuscular weakness. Patients are actively treated with antibiotics, diphtheria toxins, anti-inflammatory steroids, ACE inhibitors. The patient was implanted on a temporary pacemaker immediately after the appearance of the complete atrioventricular block under ultrasound guidance, thus helping to prevent death from this complication. The patient made a full recovery after 6 weeks of treatment.

2. PRESENTATION

The 21-year-old male patient was hospitalized on July 28, 2020, because of fever and sore throat about a week before going to medical facility. The patient was admitted to initial medical treatment until about 3 days. After that the patient suffered from difficulty swallowing increased, increased sore throat, difficulty speaking, throat with white pseudomembranous should be transferred to Gia Lai Provincial Hospital. The patient was admitted to the emergency room and Examination: Blood pressure 100/60 mmHg, heart rates 101 bpm, temperature $38,5^0$C, left tonsil swollen, throat with white pseudomembrane (Fig. 2), no difficult breath, no chest pain. The history of vaccination is unknown. The ECG show was sinus rhythm (Fig. 1).

Echocardiography with preserved EF, biochemical with white blood cell is 12.000/mm^3, liver function and renal function are still normal, and positive serum test for diphtheria. The patient is treated with Penicillin G 2.000.000 IU/l, SAD 80.000 IU/l, Methyprednisolon 125mg. On the 4th day, the patient is tired with dyspnea, low urination, blood pressure of 90/60mmHg, HR 60 PBM, Troponin I 1,158 ng/ml, BNP 697 pg/ml.

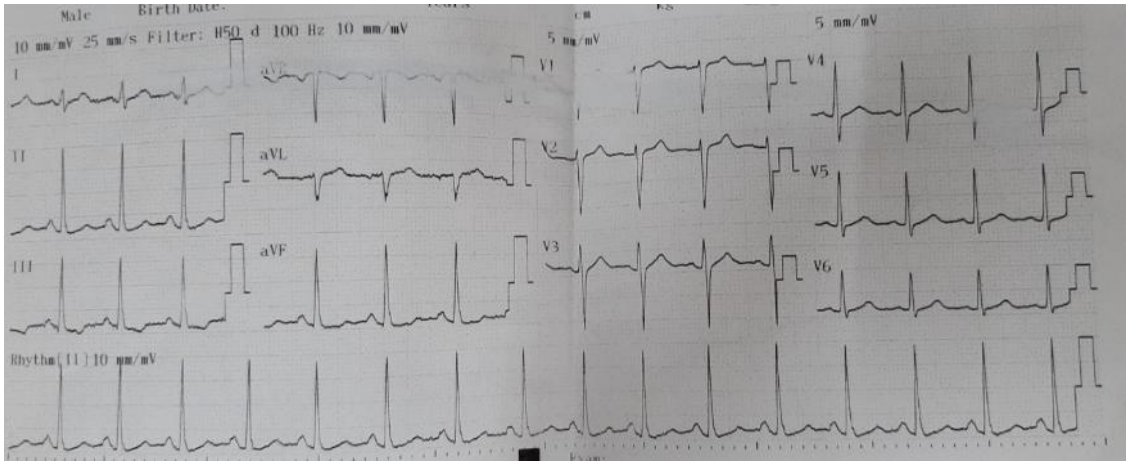

Fig. 1. ECG show sinus rhythm, heart rate 98 bpm, ST-T no specific changes

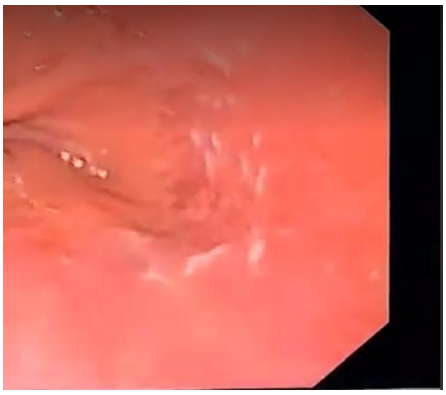

Fig. 2. Pharynx showing pseudomembranous accumulation

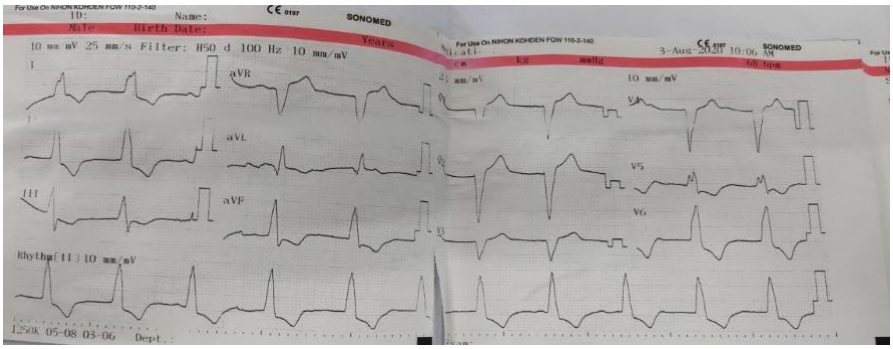

Fig. 3. ECG show wide QRS with complete atrioventricular block, heart rate 60 bpm

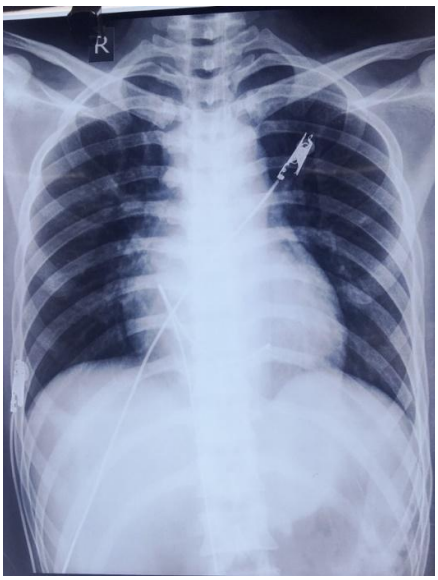

Fig. 4. Chest X-ray showing temporary pacemaker and cardiomegaly

ECG shows the wide QRS with the complete atrioventricular block (Fig. 3). The patient was an implanted temporary pacemaker on the femoral vein guided ultrasound directly after the ECG changed to prevent the bradycardia results in loss consciousness (Fig. 4) with the mode: Heart rate 70 bpm, sensing 1.5mV, output 3V. Echocardiography left ventricular systolic function decreases (Fig. 6). The patient was continued on antibiotic therapy, anti-inflammatory, antitoxin, and ACE inhibitor (Captopril 25mg). after 28 days of treatment the toxic diphtheria negative. We tried to turn off the temporary pacemaker after 2 weeks of pacemaker implantation, appear premature ventricular complex and then sinus pauses higher than 3 seconds (Fig. 5), so keep the pacemaker in standby mode, we kept trying every 2 days to check the pacemaker. The patient was then considered to have a permanent pacemaker implanted and followed up. Despite there was a very high chance of local infection from the femoral site, however, we didn't switch to jugular or subclavian vein to wait for a permanent pacemaker on this site. Patients with gastrointestinal aspiration anaphylaxis, in addition to decreased mobility

due to diphtheria toxin on the neuromuscular system, resulting in nutrient delivery through the nasogastric tube. After a total of 5 weeks of placing a temporary pacemaker at standby delay, sinus rhythm ECG with narrow QRS without spiker of the temporary pacemaker, echocardiography with left ventricular systolic function, normal heart on the radiograph (Fig. 4).

The patient continued to receive active treatment with antibiotics, nutrition, and muscle function rehabilitation due to decreased muscle mass due to neuromuscular disorders until the 6 weeks. This made the patient's hospital stay prolonged. The patient was discharged from the hospital with a stable condition, no chest pain, difficulty breathing, swallowing, cough reflexes, normal muscle movement with a totally of 6 weeks of hospitalization. Patient was discharged from the hospital in a stable condition with a complete recovery.

3. DISCUSSION

Myocarditis due to diphtheria toxin occurs 10-20% present in patients with pseudomembranous inflammation in the oropharynx, which is the main mortality factor in severe complications of diphtheria, accounting for 60-70% of the large cases of death due to diphtheria [2]. Diagnosis of diphtheria is often delayed and patients come to the medical facility often when serious complications have occurred, this leads to a decrease in the effectiveness of the diphtheria toxin-antitoxin, and an increase in mortality due to severe complications usually occurs in remote, isolated areas where access to grassroots health is limited, and with poor basic health knowledge.

The conduction system in the heart is acutely inflamed due to the action of diphtheria exotoxins that make the atrioventricular conduction system completely interrupted. The secreted toxin inhibits the synthesis of essential metabolic proteins. Diphtheria toxin acts directly on the heart by inhibiting DNA fragments and cell lysis by factor 2 activating in protein synthesis. Infiltrates are deposited on myocardial cells resulting in hyaline degeneration and necrosis. This leads to the conduction cells being affected as well. Conduction system abnormalities in diphtheria-associated myocarditis are a sign of severe damage to the heart muscle. The implementation of temporary pacemaker insertion in patients with severe conduction disturbances caused by diphtheria improved mortality by 74%. A study at the HCM City Tropical Hospital showed that the survival rate in patients without a pacemaker was 27%, in the same study that 7 (26%) out of 27 patients with temporary pacemakers survived, compared with 0 out of 16 without an on-site [3].

Diphtheria myocarditis can gradually lead to persistent conduction block, some cases have been reported in India, which suggests that not all cases of diphtheria cure can restore cardiovascular function without a lasting effect, which leads to consideration of implantation of a permanent pacemaker for long block transmission [1].

The ECG is an easy to perform, the low-cost, noninvasive probe that plays a key role in the diagnosis of arrhythmias. The prognosis of disease based on ECG is still under study, wide QRS > 120ms is an independent factor in the rate of cardiac arrest or requiring a heart transplant. One study has shown that left bundle branch block (LBBB) is a factor independent of long-term mortality in patients with diphtheria-associated myocarditis. LBBB may increase the risk of malignant arrhythmias such as ventricular tachycardia in patients with persistent diphtheria myocarditis.

Echocardiography is important in the diagnosis and elimination of other causes of heart failure (eg, restrictive cardiomyopathy, hypertrophic cardiomyopathy, congenital heart diseases). In patients with myocarditis often manifested by a decrease in ejection fraction, possibly normal in cardiac chamber diameter and septal thickening due to edematous myocardial edema infiltrates, while acute myocarditis is usually manifested by dilatation. left heart chamber with normal wall muscle wall thickness.

Diphtheria toxin resistance is valuable in the early stages of the disease but is limited when the toxin has penetrated and absorbed into the cells. The use of antitoxin is recommended for all patients with diphtheria. The efficacy of corticosteroid therapy for the prevention of diphtheritic myocarditis and neuritis was studied. The result shows that steroid therapy does not prevent the occurrence of electrocardiographic changes and neuritis in the patient with diphtheria. The role of immunotherapy such as steroids and immunoglobulins has not been demonstrated [4].

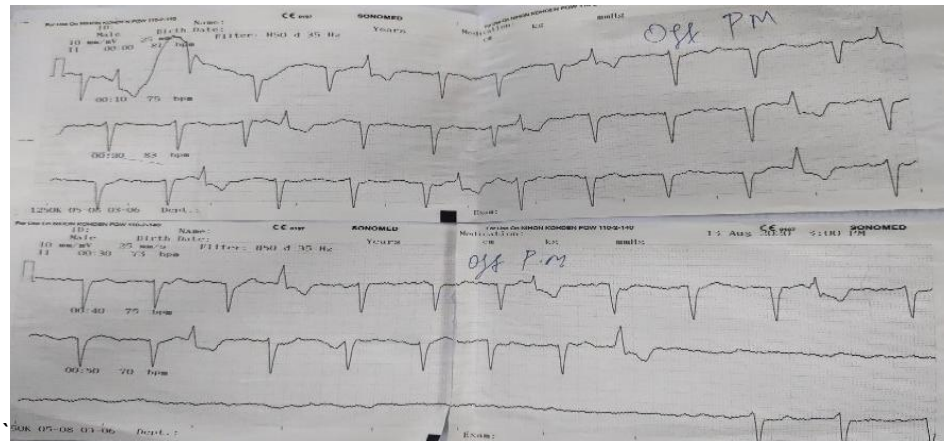

Fig. 5. This a 12 lead ECG showing a sinus pause than 3 seconds after pacemaker being turned off

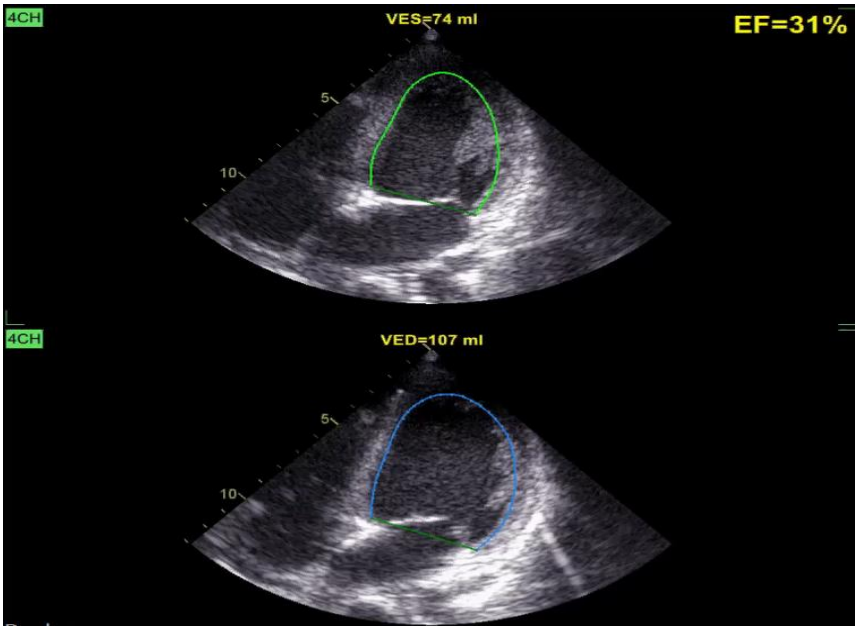

Fig. 6. Transthoracic Echocardiogram showing decreased left ventricular systolic function

Due to the early use of ACE inhibitors, it reduces myocardial reconstruction and slows the progression of dilated cardiomyopathy. Based on experimental evidence in viral myocarditis, the use of Captopril or Losartan significantly reduces inflammation, necrosis, and fibrosis of the heart [5].

Temporary pacemaker placement in patients with severe myocarditis due to diphtheria plays an important role in the treatment of severe conduction disturbances, improving cardiovascular mortality [3]. Temporary pacemaker placement often requires intervention under a DSA system, to accurately determine the electrode's direction and position and minimize possible complications. such as electrodes caught in the renal vein, the vein of the body organs, the twisted vein separates the vein when pushing blind without DSA system. However, ultrasound-guided temporary pacemaker interventions can be performed dynamically, especially in cases of infectious disease when negative pressure DSA systems are not available in poor conditions. poor facilities. Besides, the limitations when wearing protective clothing limit

the main surgeon's line of sight, so performing the procedure requires the intervention of the physician and crew to be experienced and coordinated [6].

It is important to remember the prevention of infection while caring for a patient with diphtheria infection. Process in preventing diphtheria infection, preventing droplets in cases of diphtheria. Furthermore, antibiotic prophylaxis with Azithromycin 500mg once a day or Erythromycin 500mg 4 times a day during exposure [1].

4. CONCLUSION

Temporary pacemaker implantation is a widely accepted, portable, emergency, widely accepted procedure that can be performed in bed based on ultrasound guidance, especially in the context of infectious disease, role-playing. critical role in the treatment of severe conduction disorders in the heart in emergencies, when the DSA system is not available, especially in the case of the complete atrioventricular block due to myocarditis by exotoxin diphtheria. Temporary pacemakers can be used for up to 5 weeks during the recovery of the conduction system in the heart. Diphtheria, complications of myocarditis, and severe conduction block are the leading cause of death in diphtheria, thanks to early, active intervention by temporary pacemakers, optimization of heart failure treatment during the disease. , dramatically improving prognosis and recovery of heart failure.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline patients consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Arghese Mjv, Ramakrishnan S, Kothari Ss, Parashar A, Juneja R, Saxena A. Complete Heart block due to diphtheritic myocarditis in the present era. Annals of Pediatric Cardiology. 2013;6(1):34–8.
2. Singh S, Gupta N, Saple Ap. Diphtheritic myocarditis: A case series and review of literature. Journal Of Family Medicine And Primary Ca#Re. 2020;9:5769-71.
3. Dung Nm, Kneen R, Kiem N, Bethell Db, Phu Nh, Solomon T, Et Al. Treatment of severe diphtheritic myocarditis by temporary insertion of a cardiac pacemaker. The Infectious Diseases Society of America. 2002;35:1425–9.
4. U T, J W, V K. Failure of corticosteroid therapy to prevent diphtheritic myocarditis or neuritis. Pediactric Infectious Disease. 1984;3:126-8.
5. Acosta Am, Yu Cy. Use of diphtheria antitoxin (Dat) for suspected diphtheria cases. in: diseases ncfiar, prevention Cfdca, Editors. Centers For Disease Control And Prevention. 2020;1-18.
6. Sjaus A, Fayad A. The use of subcostal echocardiographic views to guide the insertion of a right ventricular temporary transvenous pacemaker—description of the technique. Journal Of Cardiothoracic And Vascular Anesthesia. 2019;33:2797-803.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/66703