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Research Article

Diphtheria in Pediatrics: Case Report and Literature Review

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Abstract

Diphtheria is a highly contagious disease which is characterized by inflammation of the membranes, mostly in the upper respiratory tract, produced by Corynebacterium diphteriae, which generates an exotoxin, causing necrosis in the mucous membranes and also generating toxicity in the myocardium and peripheral nerves. The transmission of this disease occurs through direct contact, through infected respiratory secretions and also through skin lesions. Although it is known that it is a very infectious disease, it is also an immunopreventable disease, this is given thanks to the immunization scheme through vaccines which begins from the moment of birth and then periodically until the total completion of this. At the global level, immunization prevents childhood diseases such as diphtheria, hepatitis B, measles, tetanus, pertussis, poliomyelitis, pneumonia, rotavirus, as well as the severe and irreversible complications that can be generated from these pathologies and also decreases morbidity and mortality rates both nationally and globally.

Clinical Case: An 11-year-old female school patient, Venezuelan without a vaccination schedule, a resident of the tolú beeped sidewalk was referred to a clinic in Sincelejo on October 2, 2021, in the company of her maternal grandmother, due to suspicion of Diphtheria. Who presented unquantified febrile picture 4 days before hospital admission with the presence of edema in the neck with signs of right predominance phlogosis, pharyngeal grayish lesions, where the pediatrician on duty suspects Diphtheria vs Peritonsillar abscess.

Keywords : Diphtheria; Pediatrics; Immunization; Vaccines

Introduction

Immunization is implemented globally as it is used as a tool for the prevention of diseases, which generate complications and long-term sequelae and some of these are irreversible. Diseases such as diphtheria, measles, whooping cough, rotavirus, pneumonia, hepatitis B, among others, can be preventable through vaccination [1].

During the year 2021 several countries reported confirmed cases of diphtheria, three of them with fatal results, including Colombia with 1 fatal case. According to reports from the Americas, constant deaths have been reported since the existence of vaccination and its wide coverage since 2010. Although the COVID 19 pandemic has affected surveillance systems at the epidemiological level in recent years, it has been reported that since January 2019 the level of coverage of some vaccines has decreased, increasing the probability of high-risk populations of suffering from these vaccine-preventable diseases.

Diphtheria has been under control largely thanks to extensive vaccination coverage, but it should be remembered that the etiological agent associated with the disease is not completely eradicated, and no program aims to eliminate it. Therefore, as care coverage for childhood vaccination is reduced, this generates a drop in immunity due to the lack of reinforcements during the school years, increasing the possibility of new cases of diphtheria being reported [2]. Vaccination can be carried out without any

contraindications during the gestation time since maternal antibodies are transplacental and these will provide passive immunity to the newborn [3].

In order for the entire vaccination system to be complied with, it is necessary to encourage the family member by raising awareness about the importation of vaccines during childhood in didactic and clear ways, making known the risk that each infant runs when not having them, also teaching them to request vaccination services in their nearest health center, boldly fought against anti-vaccine groups [4]. Diphtheria is fatal in 5 - 10% of cases, with a higher mortality rate in young children. treatment consists of the administration of diphtheria antitoxin to neutralize the effects of the toxin, as well as antibiotics to produce bacterial lysis [5]. The importance of this report is that, if complete vaccination and timely identification of the clinical picture and appropriate treatment are not carried out, multidisciplinary support the development of the disease can be fatal.

Causative agent and Pathophysiology

Diphtheria is a highly transmittable disease through respiratory secretions, the patient may or may not present symptoms, since this disease has an incubation time of up to 10 days [6]. The causative agent is a large positive bacillus corynebacterium diphteriae, this produces an exotoxin which contains two components (A and B), B allows adhesion to the mucosa and A allows cell death, which causes the formation of the membrane, thus facilitating the reproduction of bacilli and the overproduction of exotoxin, to which, at the time of absorption, it will enter the blood, reaching the myocardium and peripheral nerves [7].

If the disease occurs in vaccinated patients, thanks to immunization it occurs less aggressively and organic sequelae occur less frequently. Identifiable clinical signs of this disease are gray-brown membranes attached to the mucous membranes of the upper airways, fever, weakness, myalgia, apathy, on the other hand, in diphtheria that occurs at the nasal level, this presents with serrosanguinolenta or bloody nasal secretions, pseudomembranes of limited distribution, and less frequently with general signs and symptoms [8].

Amygdalopharyngeal diphtheria is the one that usually occurs with the highest incidence and is characterized by the presence of pain in the pharynx, halitosis sialorrhea, difficulty swallowing, lifadenopathy, there are risks of aspirating detached remains of the pseudomembranes, which can obstruct the airways. The most frequent complications that occur are cardiac and neurological, such as myocarditis, which is usually evident between the first 14 days, although there are cases where it occurs during the sixth week, when the symptoms disappear, these patients may present clinical signs such as atrioventricular dissociation, heart blocks and ventricular arrhythmias, which increase the mortality rate [8].

The toxin causes a demyelination polyneuropathy, which affects the cranial and peripheral nerves. In severe cases, acute kidney failure can occur because the toxin affects the kidneys. The toxic effects usually occur during the first week of the disease, with bulbar paralysis that this causes dysphagia and nasal regurgitation, the diaphragm usually paralyzes causing respiratory failure [8].

Diagnostic Criteria

The diagnosis of this disease has 3 solid bases, in the case of an upper respiratory infection with membrane formation; the clinical part which deals with the presumptive diagnosis, samples of the exudate below the nasopharynx membrane where the result of the culture is obtained for the identification of corynebacterium diphteriae and the determination of toxigenicity (elek and pcr test) [9].

Differential Diagnosis

Treatment has two pillars application of diphtheria antitoxin and give antibiotic treatment such as penicillin or erythromycin [Table 1]. For these patients, respiratory and contact isolation is required, and should be maintained until 2 cultures, obtained in the last 48 hours after the end of antibiotic therapy, are negative.

Table 1: Differential Diagnosis of Diphtheria.

Glandular fever	The membranes are limited to the tonsils and retain their creamy white color without necrotic plaques for longer than the diphtheria membrane.
Strep throat	It causes great redness of the throat and gives a white color to the exudate. Great sore throat and distortion of the jaws, not seen in diphtheria without complications.
Vincent's Angina	It can affect gums and is identified by large staining of the exudate.

Treatment with diphtheria antitoxin should be administered without confirmation results, since the function of the drug is the neutralization of the toxin that is not bound to the cells [9]. If patients are ableto tolerate Lto oral medication, treatment should be adapted by penicillin 250 mg V.O, 4 times a day, or erythromycin 500 mg V.O C / 6h, completing 14 days of treatment. On the other hand, drugs such as vancomycin orlinezolid can be used if antibiotic resistance is detected. For cutaneous diphtheria, washing the lesions with soap and water, and administering systemic antibiotics for 10 days are recommended. Diphtheria vaccine, consisting of diphtheria toxoid, is marketed in combination with tetanus pertussis and toxoid vaccine, or exclusively with tetanus toxoid with doses of pediatric or adult diphtheria vaccine.

In other countries, there is a tendency to combine the diphtheria vaccine in the same injection with other vaccines such as pentavalent, which includes DPT, HIB, HB, and is also used in Colombia at 2, 4 and 6 months of age [10].

Clinical Case

An 11-year-old female school patient, Venezuelan without a vaccination schedule, who had a stay of 6 years ago in Colombia, resident of the tolú beeping village was referred to a clinic in Sincelejo on October 02, 2021, in the company of the maternal grandmother, for suspicion of Diphtheria. Who presented unquantified febrile picture 4 days before hospital admission with the presence of edema in the neck with signs of right predomino flogosis, pharyngeal grayish lesions, where the pediatrician on duty suspects Diphtheria vs Peritonsillar Abscess, consultation is requested with the specialist in pediatric infectology who decides to administer diphtheria antitoxin, due to the clinical deterioration referring it as a vital emergency.

Background

Pathological: Unknown.

Schoolchildren: Currently I was not in any grade.

Surgical history, medication use, allergies, and immunization are unknown.

Physical examination found vital signs. TA: 107/74 mm Hg, TAM: 90, HR: 108 bpm, FR: 26 rpm, SO2: 97% general critical appearance, lethargic, with respiratory distress, very fetid hematic sialorrhea, a ct scan of the neck was ordered to rule out injury, a laryngoscopy study is performed where erythematous tongue is observed, difficulty in visualizing pharyngeal structures due to great edema, bleeding, friability and pustular lesions with uvular predominance, peritonygdaline, glottic areas. The epiglottis, glottis and vocal cords were found with bleeding and friable edemas. Given the risk of involvement of the airway due to the progression of edema of the neck and adjacent structures, it was decided to protect the airway, in the first instance a 5.0 mm tracheal tube was placed, but due to a leak it was subsequently removed by placing a tube No. 6.0 mm MCON neumo, fixed at 18cm without complications. Subsequently, a central venous catheter was placed in the right femoral vein, with the seldinger catheter technique 5.5cm, fixed at 13cm with adequate returns without complications.

By indication of infectology he is ordered pharmacological administration of antitoxin, crystalline penicillin and clindamycin at high doses, he is performed examinations of pharyngeal cultures with telluric and blood cultures [Figure 1]. As a diagnosis was established, diphtheria under study, right peritonsillar abscess, Ludwig's angina, risks of mediastinitis.

Figure 1: Extensive lesions in the oral cavity and pharynx.

The patient is identified hypodense image, which involves the parapharyngeal, mucopharyngeal and retropharyngeal space, which presents enhancement after the administration of the contrast medium, with a diameter of 77 x 44 x 31 mm, which was related to the abscess in this location, which produces significant edema in the adjacent soft tissues as the presence of airway stenosis, which completely surrounds the endotracheal tube. It also identifies multiple well-defined oval images, located in the jugular chains bilaterally, as well as in zones I, II, III, IV as well as in the posterior cervical chain with diameters on its axis of 7mm. The presence of the thickening of the caliber of the right internal jugular vein is striking, with the presence of irregularities of this which could indicate thrombosis.

Paraclinical

As treatment the patient was managed with penicillin and diphtheria toxin medical treatment recommended by the infectology specialist is taken culture of the pharynx tranexamic acid 500mg EV then corticosteroid type mentil prednisolone was suggested, the range of antibiotic therapy (gram positive, gram negative and anaerobic) infectology considered the use of meropenem – piptazo. Subsequently, vancomycin + clindamycin + crystalline penicillin was administered [Table 2]. In view of the severe clinical compromise of the cervical structures and the CT image: The ENT decides specialized management by neck surgery, for which the process of remission to IV level is initiated, for multidisciplinary management it is followed by pediatric surgery to define the possibility of tracheostomy.

Table 2:

LACTATE: 0.54	BLOOD CULTURES AT 48HRS OF INCUVACION: NEGATIVE
GLYCOMETRY: 102	BRONCHIAL SECRETION CULTURE: NEGATIVE AT 48HRS OF CULTURE
HEMOGRAM: LEUKOCYTES: 18300 NEUTRAL: 71.8 LINF: 11.9 MON: 10.0 HB: 11.7 HTC: 35.9 PLATELETS: 2200	**THORAX RX:** BILATERAL PARAHILAR INTERSTITIAL HOPACITIES, WITH ALVEOLAR OCCUPATION HOPACITY TOWARDS THE RIGHT UPPER LOBE OF PROBABLE ATELECTASIC ORIGIN, WITHOUT OBSERVING PLEURAL EFFUSIONS
TP: 11.4 (10.8) INR: 1.08 TPT: 29.2 (26.6)	Sodium: 138
CREATININE: 1.9	Calcium: 1.06
BUM: 35.1	Potassium: 3.8
UREA: 75.11	Water balance: 2. LA: 1162.6ML
PCR: POSITIVE 6.	

The patient required invasive ventilation plus oximetry, right apical atelectasis persists with management of respiratory therapy, depends on active basal support to maintain tension figures in normal ranges, decreased diuretic rhythm, positive balance. Enteral therapy wasimplemented with hypercaloric nutritional supplementation with high protein content, in order to avoid nutritional collapse with an ominous prognosis and a high mortality rate. At 04:40hrs on October 5, 2021, the patient presented sudden cardiac arrest where advanced cardiopulmonary resuscitation maneuvers (cardiac massage, positive pressure x ambu and a dose of adrenaline) were practiced for 20 minutes without obtaining any response, dying at 05:00hrs.

Discussion

One of the primary foundations for the prevention of immunopreventable diseases is the total application of the vaccination schedule, which begins from birth and continues as the babies develop in a certain time, where the mother is notified of how often she must take her baby to the nearest medical health center, for the placement of the corresponding vaccines. The fundamental objective of vaccines is protection against these diseases, eradication is also sought at the national and global level [11]. Painfully, this goal is hindered by different factors, such as the lack of information, restricted access to health services, economic difficulties, and the different opinions of anti-vaccine people who, even knowing the consequences of not vaccinating infants, prefer not to do so, among others [12].

For years, an immunization programme known as the WHO (Expanded Programme on Immunization) (EPI) has been implemented around the world, mostly free of charge in developing countries, with the aim of reducing and eradicating mortality rates from these diseases worldwide [12]. As mentioned above, there are some factors that make impossible the main function of

the immunization system, as mentioned by the researcher Bryan Aquino-Sosa et al, who carried out an analytical study of the different factors associated with non-compliance with childhood diphtheria vaccination, among other immunopreventable diseases in Peru, year 2019, where the following results were obtained from the sample included in the study that was 7,187 ma more respondents regarding the vaccination schedule of their children over six months of age.

The components associated with the unfinished scheme by multivariate analysis were lower training level (RPa:1,19; CI95%: 1.02-1.40), not having a health insurer (RPa: 1.41; CI95%: 1.23-1.60), high poverty index (RPa: 1.21; CI95%: 1.05-1.39), age of the mother under 20 years (PR: 2.63; CI95%:2.06-3.35) and having two or more children (RPa:1.36; CI95%:1.19-1.57). With the data collected, it was concluded that the factors of poverty rates, age of the mother, a low level of education, not having the benefits of health insurance and having the responsibility of having to support more than two children, are associated with a lack in the vaccination schedule for diphtheria and other immunopreventable diseases [13].

The results obtained in thestudy, carried out by Dr. Jesús Melchor Santos Flores et al, where he represents the social elements, the reasons why the vaccination scheme is not fully complied with. The level of knowledge was 45.5 (SD=23,247). among other factors suchas cognitive: most did not know what vaccines are and the degree of importance of these in the lives of infants. Regarding the differences between complete and incomplete vaccination schedules and social factors, demonstrative differences were found in the cost of the ticket (X2 = 8.715, p = 0.033). during the study, a high prevalence of incomplete vaccination schedules was found, in conclusion, the immune schemes were not completed due to social factors, such as expenditure on means of transport, lack of availability of time to take infants to the health post and ignorance of the relevance of vaccines [14].

Conclusion

Public health has been one of the most benefited from the existence of vaccines, since these became a tool for the reduction and establishment of diseases mostly of childhood, thanks to the vaccination scheme are immunopreventable diseases, thus controlling both mortality rates and morbidity [15]. The job of health personnel is to carry out information campaigns regarding the importance and relevance of the complete vaccination scheme, since many people, especially in rural areas and who are socially vulnerable, do not have the relevant information or the necessary resources to access them [16].

For a few years now, criticism of vaccines has been generated, where bad information has been forged, resulting in many parents not wanting to vaccinate their children, which has generated an increase in outbreaks of diseases that were previously already controlled, all this due to doubts about the risk-benefit of vaccines, a serious lack of knowledge and lack of awareness of these [17]. Vaccines save lives, it is very important to inform about the benefits of immunization, involve mothers and communities in assessing the advantages of vaccination, also strengthening epidemiological surveillance where frequent cases of some of these diseases are reported, alerting health authorities to avoid the reintroduction and spread of any of these pathologies [18].

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