

A CLINICAL PROFILE OF DIPHTHERIA IN SUDANESE CHILDREN

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In contrast to much of Africa, the Sudan stands out as a country where diphtheria constitutes a significant health problem during childhood¹⁻⁴. Although no epidemics have occurred since 1978, nevertheless many cases are still reported to Khartoum Children's Emergency Hospital (KCEH) despite the implementation of the Expanded Programme on Immunization in 1985. The target of attaining 80% coverage of vulnerable children through vaccination has not yet been reached⁵; and so new cases are bound to happen. Since the diagnosis of diphtheria in many hospitals in the Sudan is essentially clinical-in common with other developing countries, due to lack of specific bacteriological investigations²⁻⁶-it is therefore, important for the practicing doctor to be familiar with the various clinical features and presentation of diphtheria in a vulnerable population such as the unimmunized group of Sudanese children.

It is the purpose of this review to examine the clinical features and presentation and to highlight some important points in the epidemiology of diphtheria based on observations from the 1978 outbreak. A full account of the epidemiology and complications has been reported elsewhere^{1,7}.

An outbreak occurred in Khartoum Province in 1978 with a peak incidence in September and October. During 3½ months, 107 children were admitted with the disease to KCEH and Khartoum Teaching Hospital. They included 48 males and 59 females, a male to female ratio of 1:1.2, which accords with the higher incidence in females reported in other studies^{8,9}.

The age distribution is shown in Table I. Fifty three (49.5%) were below 6 years of age and two (1.8%) were infants. The occurrence of diphtheria ever during the neonatal period has been reported¹⁰; and one of the youngest patients in the literature was a four day old infant¹¹. A peculiar phenomenon with respect to age incidence was observed during the epidemic by El Seed and others¹². They reported on a Sudanese woman who contracted pharyngeal diphtheria a

9 weeks of gestation from her 5 year old son. A week later, she developed weakness of her neck muscles and fluid regurgitation, followed by complete paralysis of the upper and lower limbs. Pregnancy, apart from vaginal bleeding, was not interrupted and the outcome was a female baby who had a striking elevation of IgA in cord blood (0.75 gl) but remained physically normal. It was suggested by the authors that minute concentrations of the diphtheria toxin, passing the placental barrier, might possibly have stimulated a foetal immune response without causing foetal damage.

Table I: Age distribution of 107 children admitted with diphtheria

Age (yrs)	No (%)
< 1	2 (1.8)
1 - 5	51 (47.7)
6 -10	42 (39.3)
11 -15	12 (11.2)
Total	107 (100)

The immunization status of the patients was very poor with 91.6% of them unimmunized. Four patients (3.7%) were partially vaccinated and only 5 children (4.7%) had adequate immunization. On the other hand, the high incidence of the disease amongst school age children (6-15) was remarkable, constituting 50.5% of admissions. This high incidence in the school age child compared to the one to five year group has been noted in Mcleod's review¹³ and observed by McCloskey et al¹⁴ during the 1970 epidemic of diphtheria in San Antonio, USA. The epidemiological implications of this are important and searches for carriers and school contacts have also confirmed the predominance of the organism in this age group. Out of 29 identified carriers, 22 (48.3%) were aged 6-15 years¹.

It is worth recalling that children over 6 years of age are recommended to receive the adult type of diphtheria toxoid which contains only 2Lf/units/dose to

avoid the systemic reactions which frequently result if the toxoid intended for infants and young children (7-25 Lf units per dose) is used. The former vaccine is still not available in the Sudan to cover this susceptible group, should another epidemic occur. Moreover, it would also be needed for unprotected health staff, if severe reactions were to be avoided. During an outbreak of diphtheria in the Manchester area of the United Kingdom (1967-1971), such severe reactions were commonplace among adult health workers; resulting in time off work even from 10Lf doses of diphtheria vaccine. As a consequence, an American vaccine, which contains 1.5 Lf doses of diphtheria toxoid (an adsorbed combined tetanus and diphtheria toxoid for adults) was used with negligible reactions and without the need for prior schick testing¹⁵.

In an attempt to quantify the incidence of the disease within various socioeconomic groups, families of children with diphtheria were divided into three classes. Class I included parents who were businessmen, professionals or army officers. Class II consisted of clerks, other equivalent government employees and small traders. Class III included farmers and workers. Although the disease crossed social boundaries, yet more than half of the effected children came from class III (58.4%), followed by class II (25.7) and class I (15.8%). This is in agreement with previous reports that showed a higher incidence of diphtheria amongst persons of low socioeconomic status and with limited access to health care facilities¹⁶.

The symptoms and signs of the 107 patients, recorded at the time of initial examination are shown in Table II. Fever was a presenting symptom in 99 patients (92.5%) followed by soreness of the throat (82.2%) and dysphagia (defined as pain on swallowing). Although the fever was as high as 40.2°C in some patients yet the mean initial temperature was 38.4°C. Such a modest rise of temperature is a well-recongined feature of the disease^{14,17}. However, the occurrence of dysphagia in diphtheria has been refuted in some writings and confirmed in others^{14,17}. The time-honoured observation of an increase in pulse rate to a degree which is out of proportion to that of temperature elevation, has also been noticed in this series with a mean initial pulse rate of 115/min¹⁷.

Oedema of the neck was a common sign, affecting 56 patients (52.3%). It was non-pitting, warm to touch and tender to palpation in the majority of cases (46.7%). Characteristically, it extended between the mandible and the anterior sternomastoid border either on one side (19.6%) or bilaterally (23.4%). The 'bull neck' appearance—where the swelling formed a distinct collar, reaching from ear to ear and filling out the whole space beneath the jaw—occurred in 7 cases only (6.5%). Cervical oedema confined to the submental region was seen in 3 patients being associated with diphtheria membranes on the floor of the mouth, without the involvement of the nose or throat¹⁸. However, in 51 patients (47.7%) no neck oedema was evident.

A diphtheritic membrane could be observed in 104 patients (Table III).

Table II : Symptoms and signs of diphtheria in 107 children

Symptom or sign	No (%)
1. Fever	99 (92.5)
2. Sore throat	88 (82.2)
3. Dysphagia	69 (64.5)
4. Oedema of neck	56 (52.3)
5. Neck tenderness	50 (46.7)
6. Nausea, vomiting or both	48 (44.9)
7. Headache	46 (43.0)
8. Chills	34 (31.8)
9. Nasal discharge	34 (31.8)
10. Earache	14 (13.1)
11. Cough	14 (13.1)
11. Stridor	7 (6.5)
12. Grunting	5 (4.7)

It was usually grey in colour; but pale yellow and dirty white membranes were also seen. Occasionally the membrane was dark and almost black in colour if there had been an effusion of blood. It was usually firmly

adherent leaving a raw-looking surface which bled when attempts were made to detach it. Although it dominantly involved one or both tonsils, it was frequently found, on close examination, to cross the boundaries of the tonsils to anterior and posterior pillars, the soft palate and uvula and the posterior pharyngeal wall being surrounded by an area of deep congestion. Examination of the throat also revealed a distinct offensive odour which has been described in some reviews to be 'more or less characteristic'¹⁷. This appearance of the membrane was not affected by prior administration of antibiotics¹⁴. Indeed, 40.2% of the 107 children with typical clinical features had already been on antibiotics, when reporting to hospital. However, previous immunization of the patients was reported to affect the characteristic of the membrane. It becomes less confluent, more easily removed, more follicular and rarely spreading to involve the pillars or soft palate¹⁹. On the other hand, primary nasal diphtheria was found in 4 patients (3.7%); the figures in the literature ranging between 0.7-6.4%^{20,21}; Nasal diphtheria is frequently a secondary upward extension from the fauces or pharynx and in such cases the membrane might not be visible in the anterior nares.

Table III : Diphtheritic membrane in 107 patients: Occurrence and site

	No (%)
No membrane	3 (2.8)
Membrane:	
in both tonsils	49 (45.8)
confined to one tonsil	28 (26.2)
tonsillopharyngeal	19 (17.8)
nasal	4 (3.7)
in the floor of the mouth	3 (2.8)
laryngeal	1 (0.9)

More commonly, it presents with a clear discharge that becomes purulent and may be associated with epistaxis^{17,21}. Four patients (2.8%) presented with diphtheritic membrane in the floor of the mouth, associated in one of them with a creamy-whitish membrane that covered the inferior surface of the tongue. One patient (aged 9 years) died of primary laryngeal diphtheria. A higher incidence and case fatality rates of laryngeal diphtheria has been reported in patients under 10 years of age²¹.

Other forms of the disease were not observed in this epidemic. However, such lesions are well-documented in the literature. They include cutaneous diphtheria which is thought to induce active immunity in African countries, accounting for the low incidence of respiratory diphtheria^{22,23}. Other sites which have been reported to be involved are the umbilicus, ear, conjunctiva, vagina and cervix, prepuce, buccal mucus membrane, oesophagus, stomach, anal region and various sites in the body where there have been pre-existing wounds^{17,21}. These lesions are sometimes primary but more often result from secondary infections of the nose or throat.

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