Original Article

Prevalence and outcome of neonatal tetanus in Zaria, Northwestern Nigeria

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Abstract

Introduction: Neonatal tetanus is a highly debilitating disease with high mortality. Global efforts at eliminating the disease in developing countries are yielding results but slower than expected. The high case fatality of neonatal tetanus remains a therapeutic challenge to physicians and requires continuous evaluation. This study aimed to determine the incidence and outcome of neonatal tetanus in Zaria, northwestern Nigeria.

Methodology: A retrospective study of neonatal tetanus was conducted at the Neonatal Unit of Ahmadu Bello University Teaching Hospital, Zaria, between January 2005 and December 2009. Data generated were analyzed using the Epi Info version 3.5.1 software and statistical significance was set at $p < 0.05$.

Results: Of the 2,692 newborns admitted during the study period, 20 had tetanus, giving an overall prevalence of 0.7%. There were 14 males and 6 females (male to female ratio 2.3:1). The mean age and weight at presentation were 8.3 ± 4.0 days and 2.7 ± 0.3 kg, respectively. The mean incubation period was 3.2 ± 2.0 days. Four infants (20.0%) survived, one was discharged against medical advice and 15 (75.0%) died. Factors associated with mortality were presentation at less than seven days of life, low Hendrickse score at presentation ($p = 0.0005$) and hypoglycaemia ($p = 0.0374$).

Conclusion: The incidence and the mortality rate of neonatal tetanus appear to be lower than those previously reported by our centre for the same region. Therefore, the ongoing global efforts for disease elimination and further improvements in the quality of care should be sustained.

Introduction

The global efforts at eliminating neonatal tetanus have resulted in many nations having less than one case of neonatal tetanus per 1,000 live births per district [1,2]. Although 57 countries [2], including Nigeria, were yet to attain this status as at the beginning of this millennium, there are indications that elimination of neonatal tetanus can be achieved. This laudable project of the World Health Organization (WHO) is extremely important because neonatal tetanus contributes significantly to neonatal mortality [2]. Tetanus accounts for 7% of neonatal deaths globally, and up to 20% in Nigeria [3]. Although only 5% of neonatal tetanus cases are actually reported to health services [3], the incidence of neonatal tetanus in Nigeria ranges between 14.6 and 20 per 1,000 live births [4]. Recent data [2] revealed that Nigeria contributes 16% of global neonatal tetanus deaths, second only to India. Therefore, the efforts taken to reduce infant and childhood mortality rates in Nigeria should include the reduction in incidence and mortality associated with neonatal tetanus.

While the WHO had planned to eliminate neonatal tetanus from Africa by 2005 [5], there has been no report on the impact of the organization's neonatal tetanus elimination strategies in Nigeria. Although some data on neonatal tetanus in western parts of Nigeria have been recently published by Ogunlesi *et al*. [6] and Fatuga *et al*. [7], only cases seen towards the end of the last millennium have been considered. Therefore, to assess the progress made so far in the elimination of neonatal tetanus in Nigeria, the incidence and the outcome of the disease in Zaria were examined.

Methodology

Records of all neonates managed for tetanus at the Neonatal Unit of Ahmadu Bello University Teaching Hospital (ABUTH), Zaria, between January 2005 and December 2009, were reviewed. Neonatal tetanus was defined according to the WHO criteria

Table 1. The general characteristics of the 20 neonates with tetanus

Parameters	Number of patients	(%)	Mean ± 2SD	Range
Age (days)				
≤7	15	75		
>7	5	25	8.3±4.0	6-20
Weight on admission (kg)				
<2.5	4	20		
≥2.5	16	80	2.7±0.3	2.4-3.2
Incubation period (days)				
≤2	5	25		
3-7	6	30		
8-12	4	20		
Unknown	5	25	3.2±2.0*	1-8*
Hendrickse score				
5-7	13	65		
8-10	7	35	7.4±1.5	5-10
Duration of hospital stay (days)				
<2	4	20		
2-7	7	35		
8-14	4	20		
≥15	2	10	7.3±6.6	0-23
Place of delivery				
Home	16	80		
Health facility	4	20		
Season				
Rainy	14	70		
Dry	6	30		

*The mean values and range refer to the 15 patients with obvious portal of entry

[8]. The hospital is a tertiary institution that serves as a major pediatric referral centre for communities in Kaduna State and for neighbouring states in northern Nigeria.

Information extracted from the patients' records included age at presentation, age when surgical procedures were undertaken (if any), age at onset of illness, severity of illness at admission (Hendrickse score [1]), sex, weight, place of delivery, haematological and biochemical laboratory results, and outcome of management. Data analysis was performed with Epi Info software, version 3.5.2 (CDC, Atlanta, GA, USA). Data were analyzed using Fisher's exact, Student's t or Chi square tests. A p value of less than 0.05 was set for statistical significance.

Results

During the four-year study period, 20 of the 2,692 neonates admitted to our hospital were diagnosed with neonatal tetanus. This averages to five cases per annum, giving an incidence rate of 7.4 per 1,000 neonatal admissions and an overall prevalence rate of 0.7 percent.

Demographic and clinical characteristics of the patients studied are shown in Table 1. The mean age and weight of infants at presentation were 8.3 ± 4.0 days and 2.7 ± 0.3 kg, respectively. Fourteen infected newborns (70.0%) were males and six (30.0%) were females, giving a male to female ratio of 2.3:1. The mean incubation period was 3.2 ±2 .0 days with a range of 24 hours to eight days. The average disease severity score (Hendrickse score [1]) at the time of admission was 7.4 ± 1.5. Fourteen (70.0%) of the infants were admitted between the months of May and October (rainy season), while six (30.0%) came in the dry months of November to April. Sixteen (80.0%) of the infants were born at home, three in a primary health care center, and one in the delivery suite of our hospital.

Table 2. Comparison of clinical parameters of neonatal tetanus survivors and non-survivors at presentation

Parameters	Survivors (n = 4)*	Non-survivors (n = 15)	P
Age (days)	11.3±6.2 (6-20)**	6.8±2.4 (4-14)	0.0479
Weight (kg)	2.8±0.2 (2.7-3.0)	2.7±0.7 (2.4-3.2)	0.5208
Admission temperature (^{o}C)	37.3±1.0 (36.5-38.0)	38.4±1.0 (36.5-40.5)	0.1903
Hendrickse score	9.5±0.6 (9-10)	6.8±1.2 (5-9)	0.0005
Incubation period (days)	5.5±3.5 (3-8)	2.5±1.3 (1-5)	0.0566
Duration of hospital stay (days)	16.3±5.7 (9-23)	4.7±4.1 (0-12)	0.0004
Sex			
Male (n=13)*	2 (15.4%)	11 (84.6%)	
Female (n=6)	2 (33.3%)	4 (66.7%)	0.5573

*One of the survivors was withdrawn from treatment against medical advice and was excluded from the analysis
**Mean value ± 2SD (range of values)

The suspected portal of entry was the traditional uvulectomy site in 13 cases (65%), the umbilical cord in two cases (10%), the circumcision site in one case (5%) and the scarification marks in one case (5%). The portal of entry was not obvious in three (15%) neonates.

Outcome of management

The mean duration of hospital stay was 7.3 ± 6.6 days (Table 1). Four (20.0%) patients were discharged alive while 15 (75.0%) died. One infant was discharged against medical advice. Surivors had a mean hospital stay of 16.3 ± 5.7 days while the corresponding value for non-survivors was 4.7 ± 4.1 days (Table 2).

Comparison of clinical characteristics and laboratory indices of neonatal tetanus survivors and non-survivors

The clinical characteristics of the patients studied are presented in Table 2. Of the four infants discharged alive, two were males. The case fatality rate was 84.6% in males and 66.7% in females. Thus, the survival rate was higher among females though the difference was not statistically significant (p = 0.5573). Infants presenting at older ages (11.3 ± 6.2 days) had a significantly higher survival rate than those who came at younger ages (6.8 ± 2.4 days) (p = 0.0479). Similarly, the incubation periods were generally longer in infants who survived the disease compared to those who died (5.5 ± 3.5 versus 2.5 ± 1.3 days) even though the difference failed to reach statistical significance (p = 0.0566). The average Hendrickse score for survivors was 9.5 ± 0.6, while for infants who succumbed to the disease it was 6.8 ± 1.2. Thus infants with higher scores at presentation

fared better than those with lower scores (p = 0.0005).

Laboratory values for neonatal tetanus survivors and non-survivors are compared in Table 3. It is shown that the haematological and biochemical parameters were comparable in the two groups; however, glucose levels were significantly lower in those who died while potassium levels were lower in those who survived.

Discussion

The admission of only 20 infants with tetanus over the period of four years in the present study compared to 54 cases in three years in the report of Osuhor [9] from the same hospital in 1983 suggests that neonatal tetanus has become a less common cause of neonatal admissions.

The 0.7% prevalence of neonatal tetanus in the present study is expectedly low and may be a reflection of what is happening in other parts of Nigeria. This observation is a good indication of the positive impact of the WHO neonatal tetanus elimination strategies and the possibility of achieving total elimination of neonatal tetanus from the area with sustained implementation of public health strategies. Although hospital-based figures are not the best indicators of the prevalence of a disease in the community, they nevertheless help to monitor the success of existing policies.

Most cases of neonatal tetanus were recorded during the rainy season. However, the observed difference in the incidence of neonatal tetanus admissions between the rainy and dry season did not reach statistical significance. It is therefore unlike that climatic conditions had any recognizable influence on the incidence of neonatal tetanus.

Table 3. Comparison of laboratory values of neonatal tetanus survivors and non-survivors

Laboratory test	Survivors (n = 4)*	Deaths (n = 15)	P
Haematocrit (%)	39.8±3.9 (34-42.2)**	39.7±6.6 (34-53.1)	0.9704
Total white cell count (x10^9/l)	8.6±1.3 (7.5-10.4)	8.1±2.3 (6.2-12.7)	0.7283
Platelet count (x10^9/l)	358.5±56.8 (274-392)	381.3±134.6 (133-600)	0.7571
Sodium (mmol/l)	134±3.6 (131-138)	139±9.6 (120-147)	0.3461
Potassium (mmol/l)	4.9±0.9 (4.4-5.9)	5.7±1.7 (3.9-8.0)	0.3723
Chloride (mmol/l)	96.1±0.5 (95-97)	98.8±7.9 (82.0-104)	0.5097
Bicarbonate (mmol/l)	25.5±1.7 (24-28)	25.1±3.6 (20-29)	0.8487
Glucose (mmol/l)	4.4±2.3 (2.3-6.3)	1.9±1.0 (1.1-3.7)	0.0249

*One of the patients discharged against medical advice before completion of treatment hence excluded from the analysis
**Mean value ± 2SD (range of values)

Our finding of male preponderance in the incidence and mortality of tetanus corroborates with other publications from Nigeria [10-11], although the reasons for this observation are not readily available.

In the present study, traditional uvulectomy was the suspected portal of entry in about two-thirds of cases followed by the umbilical cord in one-tenth of the patients. The local practice of cutting the uvula between the third and seventh days of life as well as the unhygienic handling of the umbilical cord may be among the factors contributing to the persistence of neonatal tetanus in this locality and will definitely require urgent dissuasive efforts to be controlled.

In spite of the decrease in prevalence, deaths from neonatal tetanus remained high, thus confirming the general opinion that neonatal tetanus mortality is high in developing countries. This phenomenon could be attributed to several factors, including the severity of illness at presentation, the limited number of skilled intensive care personnel, the inadequate facilities, and the high incidence of associated sepsis [3,7,10,12]. Although the currently reported mortality rate is high, it is however lower than the 90% reported by Osuhor [9] in 1983 for the same unit, signifying an improved outcome possibly due to improvements in the quality of neonatal care.

Patients presented within the first week of life had higher mortality rate than those seen in the second and third week of life. This finding is consistent with the results of previous studies [6,13] where it was shown that the outcome of neonatal tetanus was worse when the affected infants presented within the first week of their life. This outcome may be related to the relationship between the response of the immune system and the toxin load at this age compared to the one of older infants with more matured immunity [6], in that the relatively immature immune system of newborns in the first week of life could be easily overwhelmed by the toxin load.

The majority of the mortalities in the present study occurred within the first seven days of admission, a finding that supports the results of other reports in Nigeria [6,11]. This outcome may be attributed to persistent actions of the tissue-bounded tetanus toxins, difficulty in controlling spasm and difficulty in achieving adequate fluid and caloric balance during this period. Therefore, the first week of hospitalization is critical in the management of neonatal tetanus [6,11] and efforts targeted at improved outcomes should focus on this critical period.

The relatively low Hendrickse score in many of the patients with fatal outcome suggests delayed presentation and hence severe disease. Further studies on the reasons for this delayed presentation are needed to provide practical measures at ensuring early presentation to hospital. Although some authors [14] have speculated that low level of awareness, low socio-economic status, practice of the purdah system, and certain cultural beliefs might be possible contributory factors to late presentation, there is need for local studies to evolve more appropriate and locally adaptable measures. However, some cases of neonatal tetanus could present with a short incubation period that may not allow the caregiver to have ample time to prepare for early hospital attendance. Furthermore, the incubation period in most of those with fatal outcome was short which itself connotes poor prognosis [15]. The reason for the shorter incubation period in the present study is not certain but may be related to the high prevalence of traditional uvulectomy in the study population. The pharynx is closer to the central nervous system than the umbilical cord which tends to be the commonest

portal of entry in studies that reported longer incubation periods [6,10]. The closer the portal of entry to the central nervous system, the shorter the incubation period [16].

The biochemical indices of the patients studied were essentially within the normal ranges with the exception of potassium levels, which were higher, and blood glucose levels, which were lower in infants with fatal outcome. Elevated potassium levels are not unusual in view of the potential of rhabdomyolysis from sustained muscle contraction, deposition of myoglobin in renal tubules, and consequently decreased renal function [12,17].

Prolonged skeletal muscle contraction places high demand on energy and hence high glucose consumption. This condition is reflected in this study by the high proportion of infants with low blood glucose levels. On the other hand, severe trismus prevents affected newborns from achieving adequate attachment on the breast and sufficient suckling which might result in hypoglycaemia. Since hypoglycaemia may have contributed to the demise of some of these patients the need for prompt and adequate caloric supply is emphasized.

Conclusion

Although neonatal tetanus is still prevalent in this locality, the incidence and mortality rate are reduced compared to those of a previous study from the same centre, possibly due to improvements in public health strategies. Therefore, the ongoing global efforts at disease elimination should be sustained while further improvement in the quality of care should be ensured.

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Conflict of interests: No conflict of interests is declared.