



## Post Neonatal Tetanus as Seen in Rivers State University Teaching Hospital, Nigeria: Prevalence, Clinical Profile and Outcome

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### Authors' contributions

This work was carried out in collaboration between both authors. Author TGO performed the statistical analysis. Both authors performed literature search, produced the draft manuscripts, read and approved the final manuscript.

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### ABSTRACT

**Background:** Post neonatal tetanus, a vaccine preventable disease is a cause of childhood morbidity and mortality in many developing countries including Nigeria. This study was carried out to determine the prevalence, clinical profile and outcome of children with post-neonatal tetanus.

**Methods:** This prospective observational study carried out over 3years in the Paediatric ward of the Rivers State University Teaching Hospital, was among children older than 28days and up to 16years.

**Result:** Of 966 children admitted during the period of study, 12 had post-neonatal tetanus giving a prevalence of 1.2%. Six (50%) were > 10years old with a M:F ratio of 5:1, 5(41.7%) resided in rural areas and all (100%) were of low socioeconomic status. Six (50%) did not receive tetanus toxoid vaccine and no child had booster doses. Portal of entry for the infection was majorly via injuries on their limbs, 7(58.3%). The mean incubation period was 10.58±7.39 days while the mean onset interval was 31.58±27.85 hours. Three (25%) children had severe tetanus using Ablett's classification with spasm 11(91.7%) documented as the commonest symptom. Half, 6(50%) of the children had autonomic complications and an overall case fatality rate of 25%.

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**Conclusion:** The prevalence of post-neonatal tetanus in the Rivers State University Teaching Hospital was low being 1.2%, although unacceptable. The mortality rate of post-neonatal tetanus of 25% was high. Thus, there is a need to strengthen existing immunization program and immediately adopt the commencement of booster doses of tetanus toxoid vaccines for eligible children in Nigeria.

*Keywords: Post-neonatal tetanus; prevalence; clinical profile; outcome; teaching hospital, Nigeria.*

## 1. INTRODUCTION

Tetanus, a non-communicable disease of public health interest, commonly occurs in developing countries. [1] It is a disease condition with significant morbidity and mortality accounting for an estimated incidence of about 700,000 to 1 million cases per year. [2] Nigeria is one of the 27 countries accounting for about 90% of the global tetanus burden. [3].

It is caused by an obligate anaerobe, *Clostridium tetani*, a gram-positive motile spore forming bacilli. [4] Tetanus spores are ubiquitous and are mainly found in the soil, dust and animal faeces. Neonatal tetanus which occurs in the first 28 days of life results from unclean deliveries as well as unhygienic umbilical cord care practices [5]. Post neonatal tetanus (PNT), on the other hand, occurs after the neonatal period as a result of contamination of wounds with dirt, faeces or saliva, puncture wounds (nail or needle), burns, otitis media, dental infections and crush injuries. [6,7] Studies have also reported broom stick injuries as a portal of entry. [8,9]

The incubation period is between 3-21 days. Once the tetanus spores gain entrance into the body, they germinate in the presence of anaerobic conditions and produce very potent neurotoxins called tetanospasmin which acts on the central and sympathetic nervous systems. At the wound site, tetanospasmin binds to the presynaptic motor neurons and travel retrogradely to the spinal cord within 2-14 days. It binds to the central inhibitory neurons at the spinal cord, preventing the release of gamma-aminobutyric acid (GABA) and glycine-containing vesicles which are inhibitory neurotransmitters. The resultant effect is the loss of inhibitory actions on motor and autonomic neurons, responsible for the clinical symptoms of uncontrolled muscle spasms and autonomic hyperactivity seen in tetanus. [5-7].

Neonatal tetanus although commoner is now observed to be on the decline whereas post-neonatal tetanus still remains a growing problem in developing countries. [10-13] This is attributable to poor immunization coverage, lack

of sustained immunization programs as well as deficient booster doses for eligible children. [12,14].

Symptoms of tetanus include sudden onset of painful contractions of the muscles of the face, jaw, neck and back, generalized muscle spasm manifested by trismus, dysphagia, neck stiffness, abdominal rigidity and hypertonia. [13,15].

Tetanus can be prevented only via vaccination with tetanus toxoid vaccines and immunization coverage rates of up to 95% is needed for its sustained control. [16] The World Health Organization (WHO) recommends three primary and three booster doses of tetanus toxoid vaccines in order to achieve protection for life. [17] The three primary doses are given at ages 6 weeks, 10 weeks and 14 weeks respectively while the three booster doses are administered at 12-23 months, 4-7 years and 9-15 years respectively. [17] It is worthy of note that the primary doses confer immunity in the first 4 years of life, whereas the booster doses confer long term immunity. [18] Nigeria adopted the WHO immunization guidelines over four decades ago, but is yet to implement booster doses vaccination. In addition, the immunization coverage rate in Nigeria has remained consistently low with an unacceptably low DPT 3 coverage rates of only 50% from the most recent data. [19].

The mortality rate of tetanus is very high (28/100,000 population) in developing countries in contrast to developed countries with rates lower than 0.1/100,000. [20] In Nigeria, the mortality rate ranges from 38% to 60%, [15,20] and is worse in the neonatal period. Factors responsible for the low mortality rate of tetanus in the developed countries include widespread tetanus toxoid vaccine coverage, better health care system, improved wound care and the use of post exposure tetanus immune globulin. [21].

No study has been carried out on post-neonatal tetanus in the Rivers State University Teaching Hospital. The present study is therefore being carried out to determine the prevalence, clinical

profile and outcome of post-neonatal tetanus in Rivers State, Nigeria. Findings from this study would also be useful in strengthening immunization policies, as well as create an awareness on the need to improve health care services in the state and the country at large.

## 2. MATERIAL AND METHODS

### 2.1 Study Site

Rivers State University Teaching Hospital located in the capital city of Port Harcourt is the state-owned tertiary health facility with 375 beds. It serves as referral to all the Primary Health Care centres in the 23 Local Government Areas, state-owned general hospitals as well as the private health facilities in and around the state. The hospital is made up of the departments of Paediatrics, Obstetrics & Gynaecology, Surgery, Anaesthesia, Internal Medicine, Pathology, Pharmacy, Radiology, Physiotherapy, Nursing etc. The department of Paediatrics consist of various specialties/units such as Infectious disease unit, Endocrinology, Nephrology, Haem-oncology, Neonatology and Social Paediatrics. Each of these units are run by 1-3 consultants, resident doctors and house officers. Each unit has clinic day(s) and day(s) for ward rounds. The Paediatric ward has a unit set apart for the care of tetanus patients (Tetanus unit). This ward which is kept dark is located at the extreme of the ward away from noise.

### 2.2 Methods

The present study was a prospective observational study carried out in the Paediatric ward of the Rivers State University Teaching Hospital over three years, from January 2016 to December 2018.

Informed consents were obtained from the parents/caregivers of children with tetanus before recruitment. All children with a diagnosis of tetanus made by a consultant, who are greater than 28days to 16 years and whose parents/caregivers gave consent were enrolled into the study whereas, children less than 28days old with tetanus diagnosed by a consultant or age greater than 16years or whose parents/care givers did not give consent were excluded from the study.

Post neonatal tetanus was defined as children greater than 28days to 16years with acute illness characterized by muscle spasm and generalized

hypertonia. [22] For every recruited patient, a research proforma was administered. Demographic information obtained from the parents/caregivers were age, sex, place of residence, highest level of education and occupation of parents/caregivers. Social status was determined using classification by Oyedeji et al. [23] Other information obtained were the vaccination status of each child with tetanus and possible portal of entry of infection. The children were followed up while on admission and all complications and clinical outcome were documented on the proforma. Incubation period was defined as the interval between the acute injury and the presence of first symptom while the onset interval was defined as the interval between the first symptom and first spasm. [24] Post neonatal tetanus was classified according to severity into mild, moderate, severe and very severe using Ablett's classification. [25]

All cases of PNT were managed according to the department's management protocol.

### 2.3 Statistical Analysis

Data were entered into Microsoft Excel spreadsheet and analyzed using SPSS version 23. The results were presented in frequency tables and percentages. Because of the small sample size, fishers exact test was used as a test of association to determine the level of significance between the outcome and independent variables. Statistical significance was considered if P value was < 0.05 at 95% confidence interval.

## 3. RESULTS

### 3.1 Demographic Data

Twelve participants who met the inclusion criteria participated in the study. A total of 966 patients were admitted into the Paediatric ward from January 2016 to December 2018, giving a prevalence of post neonatal tetanus at 1.2%. Twelve children aged 5-14years participated in the study, 6 (50%) were aged more than 10years. The mean age of the study population was 10+2.68 years. Ten (83.3%) males participated in the study, with a male: female ratio of 5:1. Five (41.7%) of the children resided in rural areas and secondary school education was the highest form of education obtained by female (41.7%) and male (58.3%) caregivers. About 7(58.8%) of the mothers were traders. All the children were from families with low socioeconomic status, Table 1.

**Table 1. Demographic characteristics of study population**

Parameters	Frequency	Percentage
<b>Age group</b>		
1-5	2	16.7
6-10	4	33.3
> 10	6	50
<b>Gender</b>		
Female	2	16.7
Male	10	83.3
<b>Location of residence</b>		
Rural	5	41.7
Urban	7	58.3
<b>Mother's educational level</b>		
None	1	8.3
Primary	6	50
Secondary	5	41.7
Tertiary	0	0
<b>Father's Educational level</b>		
None	3	25
Primary	2	16.7
Secondary	7	58.3
Tertiary	0	0
<b>Mothers' Occupation</b>		
Unemployed/housewife	3	25
Skilled workers	2	16.7
Traders	7	58.3
<b>Father's Occupation</b>		
Unemployed	3	25
Skilled workers	4	33.3
Traders	4	33.3
Public Servants	1	8.3
<b>Socioeconomic class</b>		
1	0	0
2	0	0
3	0	0
4	7	58.3
5	5	41.7

### 3.2 Clinical Profile

Half, 6 (50%) of the participants did not receive tetanus toxoid vaccine at infancy, while the vaccination status of 2 (25%) was unknown. No child had booster doses of tetanus vaccination. Eleven children (91.7%) had known portal of entry as they had one form of injury or the other. The portal of entry of one them was not known (a 13year old female who had achieved menarche and presented with vaginal bleeding). Of the 11 patients who had injuries, 7 (58.3%) sustained injuries on the limbs while playing and 2 (16.7%) had broomstick injury, Table II. Majority of the injuries were located on the lower limb 8 (72.7%) and 3 (27.3%) on the upper limbs.

The incubation period ranged from 2-30 days with a mean of  $10.58 \pm 7.39$  days. The mean onset

interval was  $31.58 \pm 27.85$  hours. All the 12 (100%) children had generalized form of tetanus. Using the Ablett's classification for severity, 3 (25%) had severe and 2 (16.7%) very severe tetanus. Spasms, 11 (91.7%) was the commonest symptom found among the children, followed by trismus 9 (75%) and stiffness of the body 8 (66.7%), Table 2.

### 3.3 Outcome of Post Neonatal Tetanus

Six (50%) children had autonomic complications and 4(33.3%) had sepsis, Table 3. Of all the children treated, 8 completed their treatment and were discharged home alive while three died, giving a case fatality rate (CFR) of 25%. Of the three that died, the duration of admission was 11 hours to 5 days. The mean duration of admission

before demise was  $2.82 \pm 2.28$  days while the mean duration of hospitalization for all PNT cases was  $10.88 \pm 9.47$  days. The caregivers of one of the children requested for discharge against medical advice (DAMA) on the 10<sup>th</sup> day of admission. Of the 11 children that completed treatment in the hospital, although not statistically significant, more males 2 (66.7%) than females died, as well as greater mortality occurred among those who had an onset interval of 24 hours or less, had severe or very severe disease, autonomic complications and hospitalization of less than 7 days, (Fisher's exact test > 0.05), Table 4.

#### 4. DISCUSSION

The 1.2% prevalence of post neonatal tetanus obtained in this study was low and is comparable to the prevalence rate of 0.9% in Asaba, [26] 1.7% reported by Ogunfowora et al [27] in Sagamu, but higher than 0.6% reported by Animasahun et al [28] in Lagos and lower than the 2.7% reported by Oyedeji et al in Osogbo. [29] The differences observed in these studies could be as a result of geographical differences

and differences in methods used in these studies. The lower prevalence rate observed in the Lagos study may be due to the fact that it only included children aged 1 month to 12 years, unlike this study that included children aged up to the age of 16 years. Although the prevalence of PNT obtained in this study was low, it is however not acceptable as post neonatal tetanus is a vaccine preventable disease and we expect children especially those in urban residences as observed in this study to be fully vaccinated. Furthermore, adequate vaccination and proper management of childhood injuries when they occur will bring the incidence of PNT to the barest minimum. [16,17,21].

A study carried out in a tertiary health facility in Osogbo, [29] reported that PNT was commoner among children aged 10 years and above as observed in this study. The same observation was also made in an earlier study conducted in a different tertiary health facility in Port Harcourt. [30] This finding was however contrary to that reported in Calabar, [31] and Lagos [28] where the prevalence of PNT was higher among children aged 5-10 years. The differences

**Table 2. Clinical profile of the study population**

Parameter	Frequency	Percentage
<b>Vaccination status</b>		
Completed at infancy	3	25
Partially vaccinated	1	8.3
Not vaccinated	6	50
Unknown	2	16.7
<b>Portal of entry</b>		
Trauma	7	58.3
Broom stick	2	16.7
Nail injury	1	8.3
Fracture	1	8.3
Unknown	1	8.3
<b>Severity of Tetanus</b>		
Mild	3	25
Moderate	4	33.3
Severe	3	25
Very severe	2	16.7
<b>Clinical features</b>		
Spasms	11	91.7
Trismus	9	75
Stiffness of the body	8	66.7
Fever	6	50
Diaphoresis	5	41.7
Difficulty in breathing	3	25
Apnoea	1	8.3
Chest pain	1	8.3
Hypotension	1	8.3

**Table 3. Complications and clinical outcome of tetanus among the study population**

Parameters	Frequency	Percentage (%)
<b>Complications</b>		
Autonomic	6	50
Sepsis	4	33.3
Anaemia	2	16.7
Pneumonia	1	8.3
Respiratory Failure	1	8.3
<b>Outcome</b>		
Discharged home	8	66.7
Died	3	25.0
Discharged against medical advice	1	8.3

**Table 4. Association of demographic and clinical variables with outcome of post neonatal tetanus**

Parameter	Outcome		Fisher's exact test
	Alive N (%)	Dead N (%)	
<b>Age group (years)</b>			
5	1 (12.5)	1 (33.3)	0.491
> 5	7 (87.5)	2 (66.7)	
<b>Gender</b>			
Female	1 (12.5)	1 (33.3)	0.491
Male	7 (87.5)	2 (66.7)	
<b>Location</b>			
Rural	3 (37.5)	1 (33.3)	0.721
Urban	5 (62.5)	2 (66.7)	
<b>Incubation Period (Days)</b>			
< 7	1 (12.5)	2 (66.7)	0.152
> 7	7 (87.5)	1 (33.3)	
<b>Onset interval (Hour)</b>			
< 24	2 (25)	3 (100)	0.061
> 24	6 (75)	0 (0)	
<b>Severity of illness</b>			
Mild & moderate	6 (75)	0 (0)	0.061
Severe & very severe	2 (25)	3 (100)	
<b>Presence of complications</b>			
No	5 (62.5)	0 (0)	0.121
Yes	3 (37.5)	3 (100)	
<b>Presence of autonomic complications</b>			
Yes	3 (37.5)	3 (100)	0.121
No	5 (62.5)	0 (0)	
<b>Duration of hospitalization (Days)</b>			
<7	2 (25)	3 (100)	0.061
> 7	6 (75)	0 (0)	

observed could be as a result of geographical differences where the studies were carried out. In addition, the higher prevalence found among young adolescents in our study may be due to the fact that because they are older, they tend to be more adventurous and outgoing, thereby making them prone to accidental injuries while playing. The fact that the commonest portal of entry in

this study was from traumatic injuries corroborates it. The higher prevalence of PNT among male children as observed in this study is well documented in other studies [26-30] and this has been alluded to males being more involved in outdoor activities and therefore more prone to injuries than their female counterparts.

The parents/caregivers of all the children with PNT in this study were from low socio-economic class as also reported by Ajite et al in Ekiti. [32] In other studies in Nigeria, majority of children treated for PNT were also from families with low socio-economic class. [27,31] The exact reason for this observation is not known, it has however been attributed to the fact that these children are more exposed to poor hygienic environments, have risky behaviours like playing barefoot and unsupervised outdoor play. Besides, the caregivers of such children are more likely to be involved with poor health seeking behaviours and inappropriate treatments of injuries at home.

The vaccination status of children has always been of concern when children develop tetanus. This is because complete vaccination with tetanus toxoid at infancy and adequate booster doses at school age and adolescence protect children from developing tetanus [16,17,18,21]. It was therefore not surprising that half of the children in this study were not vaccinated, 8.3% did not complete the primary DPT series at infancy and no child received booster doses of tetanus toxoid vaccine. The same observation was also noted by earlier studies reported by Yaguo Ide et al [8] in Port Harcourt and in other studies carried out in Nigeria, [26,27,29,31] and Ethiopia. [33] It is quite interesting that the mean age of the study population of  $10 \pm 2.68$  years, similar to that reported in other studies in the country [28-30] may be contributory to the higher incidence of PNT among children in the older age groups. It is pertinent to note that the 3 doses of tetanus toxoid vaccine given to infants in the primary immunization series in Nigeria protects them from tetanus for about 3-4 years. It does not confer adequate protection against tetanus to children in the older age groups. [16,17] Besides, Scobie et al in their study in East Africa, reported that the sero-protection to tetanus is low in children aged 5-14 years, making children in this age group prone to tetanus. This is more prevalent when they have penetrating injuries, in the absence of booster doses of tetanus toxoid. [34].

The commonest portal of entry observed in this study was post traumatic injuries, followed by broomstick injury. Post traumatic injury was also the most frequently documented portal of entry in other studies in Nigeria, [27,29,31] India, [35] and Ethiopia. [33] Probably because children are prone to injuries while playing especially outdoors in the sand, where their wounds can be easily contaminated with the spores of

*clostridium tetani*. In earlier studies conducted in Port Harcourt, [8,30] broomstick injury was however the commonest portal of entry. This portal of entry for PNT was also documented by Komomo et al [31] and Ijjezie et al [36] in Calabar and Uyo respectively. The study at Uyo, reported that this injury is obtained when caregivers flog their children with the broom, mostly when upset with them. [36] It is however interesting to note that broomstick injury as a portal of entry was only documented in studies carried out in the south-south geopolitical region of Nigeria and not in other parts of the country [26-30] or in other countries. [33,35] One can only ponder at this stage if this behaviour of using broom to flog children is peculiar to this geopolitical zone of the country or if it was erroneously omitted in studies from other parts of Nigeria. Further research maybe needed to clarify this observation.

Also interesting is the fact that there were no cases of otogenic tetanus in our study, contrary to the study in India, [35] where it was the commonest portal of entry. There were also documented cases of otogenic tetanus occurring in other studies in Nigeria. [29,30,37] The reason for this is not apparent.

For children who develop PNT from post-traumatic injuries, the injury can occur in any part of the body. In this study, the lower limb was the commonest site of injury followed by the upper limb. This finding was also elicited in studies reported in Nigeria [26-28] and Pakistan. [38] The studies in Sagamu, [27] Asaba [26] and Pakistan [38] documented PNT occurring following injuries to the scalp but this was not found in the present study.

The case fatality rate (CFR) of 25% in this study is comparable to 22.7%, reported in Calabar, [31] 27.2% in Port Harcourt [8] and 29.2% in Ethiopia. [33] The CFR was however much higher than the 4.1% reported by Animasahun et al [28] in Lagos, probably because most of the patients in their study did not have complications and besides the study did not state the severity of the tetanus their participants presented with. The CFR in this study was however lower than the 50% reported in Asaba, [26] 35.7% in Sagamu, [27] Nigeria and 40% and 33.3% in different health facilities in India. [35,39] The differences observed may be due to the methodologies used in these studies and the severity of tetanus among the participants. For example, Angurana et al [39] in their study, included only patients with severe and very severe tetanus according to

Ablett's classification, admitted into Paediatric intensive care unit. In Sagamu, [27] almost 2/3<sup>rd</sup> of the children included in the study had severe and very severe disease which is in contrast to our study where more than half of the participants had mild and moderate disease. Besides, the CFR could also be influenced by the different treatment protocols employed by each facility, availability of pediatric intensive units and trained manpower to treat these patients.

In concordance with other studies, [26,27,33,39] although not statistically significant, the CFR was higher among children with severe and very severe disease and those with short incubation period of less than 7 days. [35] Studies in Pakistan, [40] India [35] and Ethiopia [33] reported that the presence of complications especially autonomic instability in patients with PNT was associated with higher case fatality rates as also observed in this study. Also worrisome is the higher CFR observed in the first 7 days of admission as also seen in other studies in Nigeria [27] and outside the country. [35,38,39] This observation may be indicative of the severity of the illness and this mortality rate in our study could perhaps have been reduced if we had an intensive care unit with ventilators to take care of respiratory failure and adequately managed other complications.

## 5. CONCLUSION

The prevalence rate of tetanus in this study is low but unacceptable because tetanus is a vaccine preventable disease and is taking place in a society with free National Immunization Program and among children from poor socio-economic families. Improved vaccination coverage especially among the hard to reach and vulnerable groups especially the poor, will prevent such mortalities from PNT.

## CONSENT

As per international standards, informed consent was obtained from the parents or caregivers of the children.

## ETHICAL APPROVAL

Ethical approval was obtained from the Ethical Committee of the Rivers State University Teaching Hospital.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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