

Tetanus Immunisation in a Cohort of Adults Seen in an Accident and Emergency Unit of a Tertiary Health Facility in Nigeria

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ABSTRACT

Background: Tetanus remains a major health problem in many developing countries including Nigeria. Most cases of tetanus in the developing countries are in the young people under 40 years. In view of the high mortality from tetanus, prevention remains the best form of treatment.

Objective: The objective was to determine the effectiveness of anti-tetanus immunisation in a cohort of Nigerian adult population.

Methods: Patients with open injuries and controls without open injuries were investigated. Blood samples for IgG Anti-Tetanus Antibody (ATAb) assessments were taken from patients and controls on admission before giving anti-tetanus toxoid (ATT) and at 4 weeks later. Serum ATAb was quantitated using Tetanus Toxoid IgG ELISA Kit (Demeditec Diagnostics, Germany). ATAb results were expressed in International Units per millilitre (IU/mL). ATAb levels > 0.1 IU/mL were considered protective.

Results: A total of 159 patients and 90 controls were studied. The mean of ATAb patient was 1.13 (2.37) IU/mL, higher than the mean of 0.76 (1.4) IU/mL in controls. In both the patients and controls, females had higher baseline ATAb levels; this was statistically significant in controls ($P < 0.002$). Seventy-five (47.2%) patients and 47 (52.2%) controls did not have protective ATAb levels. Four weeks after immunisation, the rise in ATAb was, however, >8-fold and the percentage of patients that required immunisation dropped from 47.2% to 10%. Although 11 (30%) patients had a history of ATT, their serum ATAb was not higher than those who did not have a history of ATT - 1.02 (1.51) IU/mL and 1.19 (2.67) IU/mL, respectively.

Conclusion: There was a good response to ATT immunisation. Therefore, anti-tetanus immunisation should be continued in hospitals.

Key words: Accident and Emergency Unit, adults, anti-tetanus immunisation, Nigerians

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INTRODUCTION

Tetanus remains a major health problem in many developing countries including Nigeria. There has been no reduction in the incidence of tetanus over the years in spite of availability of protective immunisation, and mortality rate is still very high.^{1,2} Most cases of tetanus are in the young, productive segment of the population, usually under the age of 40 years in developing countries,¹⁻⁵ unlike in the developed countries where tetanus mainly afflicts the elderly who are believed to have lost their immunity to tetanus.^{6,7}

Because of the high mortality rate from tetanus, prevention remains the best form of treatment. The aim of the present study was to determine if the serum levels of anti-tetanus immunoglobulin in patients with open injuries in the Accident and Emergency Department of Obafemi Awolowo University

Teaching Hospitals Complex, Ile-Ife, Nigeria, were up to the protective levels against tetanus.

SUBJECTS AND METHODS

Subjects were patients seen at the Accident and Emergency Unit of the hospital for various forms of injuries resulting from varying causes. Written and verbal consents were also obtained from each patient and control. Apparently healthy hospital workers were recruited as controls.

Blood samples for IgG anti-tetanus antibody assessment were taken from patients before administering tetanus toxoid on admission, and at 4 weeks post-immunisation. Blood samples for IgG anti-tetanus antibody were also taken from the controls

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at recruitment. Both patients' and controls' serum samples were from whole blood and stored at -80°C until analysed.

Serum levels of anti-tetanus antibody were quantified using Tetanus Toxoid IgG ELISA Kit (Demeditec Diagnostics GmbH*Lise-Meitner-Straße 2*D, 24145 Kiel, Germany) according to the manufacturer's instructions. Samples were retrieved and allowed to thaw at room temperature and estimated in batches. Samples and standards were subjected to ELISA reaction, and the absorbances were read using IRE 96 ELISA Absorbance Microplate Reader (SFRI Medical Diagnostics, France). Tetanus antibody results were expressed in International Units per millilitre (IU/mL). Tetanus antitoxin levels >0.1 IU/mL were considered protective.⁸ Data were analysed using the Statistical Package for the Social Sciences version 17 (SPSS Inc., Chicago, USA, 1993–2008) and were presented as means and standard deviation. The means were compared using independent sample *t*-test with the level of statistical significance set at $P < 0.05$.

RESULTS

A total of 159 injured patients comprising 114 males and 45 females were investigated. The data on ages are summarised in the Table I. The means of ages of males and females were 33.98 (14.34) and 36.87 (19.77) years, respectively. The difference was not statistically significant ($P = 0.309$).

The patients sustained injuries ranging from contusion, abrasion, lacerations and avulsion to severe crush injuries; sustained as a result of road traffic accidents, domestic violence, gunshot wounds, snake bites, accidental falls, human bites and others.

Seventy-eight males and 12 females were similarly investigated as controls. The means of ages of males and females among controls were 28.42 (8.03) and 33.33 (12.82) years, respectively. Although the means of ages of males and females among controls were less than that of the patients, the differences were not statistically significant ($P = 0.074$).

Although a total of 159 patients were recruited, only 50 (23.5%) of them reported for re-evaluation 4 weeks after immunisation with tetanus toxoid. Table I also shows the anti-tetanus antibody levels in patients and controls. The mean of baseline serum anti-tetanus antibody levels among patients was 1.13 (2.37) IU/mL, higher than the 0.76 (1.4) IU/mL for the controls though the difference was not statistically significant. The means of baseline serum anti-tetanus IgG levels in the control were 0.59 (1.24) IU/mL and 1.96 (1.80) IU/mL for males and females, respectively, whereas in the patients, the values were 1.12 (2.64) IU/mL and 1.15 (1.50) IU/mL, respectively.

The means of serum IgG anti-tetanus antibody levels were higher in females than males in both groups and was statistically significant in the controls ($t = -3.21$, $P = 0.002$) as shown in Figure 1. By the international standard, 75 (47.2%) of the 159 patients required immunisation as their serum level of antibody to tetanus were <0.10 IU/mL, which is the acceptable minimum protective level. However, the value reduced to 10% 4 weeks after immunisation. Similarly, 47 (52.2%) of the 90 controls had serum antibody to tetanus <0.10 IU/mL, and so would normally have needed to be immunised.

Four weeks post-immunisation, the mean serum anti-tetanus immunoglobulin levels in the patients rose from baseline value of 1.13 (2.37) IU/mL to 9.22 (11.25), more than 8-fold rise ($P = 0.000$) as shown in Figure 2. Eleven (29.7%) of the 37 patients confirmed to have had anti-tetanus immunisation in the past, their mean serum anti-tetanus IgG was even lower than those without previous anti-tetanus immunisation, 1.02 (1.51) IU/mL and 1.19 (2.67) IU/mL, respectively. Of the 37 that had a history of previous anti-tetanus immunisation, thirteen (35.1%) of them returned for re-evaluation, whereas 45 (41.3%) of those who did not have a history of tetanus immunisation returned for re-evaluation. Four weeks after immunisation, the mean of serum levels of anti-tetanus IgG in those without previous immunisation was 9.40 (11.57) IU/mL; surprisingly, higher than the 8.69 (10.74) IU/mL in who had a history of immunisation though the difference was, however, not statistically significant. Re-evaluation after 4 weeks,

Table I: Serum anti-tetanus IgG levels in patients pre- and post-immunisation

Variables	Patients (%)			Controls (%)		
	Overall (n=159)	Male (n=114)	Female (n=45)	Total (n=90)	Male (n=78)	Female (n=12)
Age (years)	34.80 (16.05)	33.98 (14.34)	36.87 (19.77)	29.08 (8.88)	28.42 (8.03)	33.33 (12.82)
BS anti-tetanus IgG (IU/mL)*	1.13 (2.37)	1.12 (2.64)	1.15 (1.50)	0.76 (1.39)	0.59 (1.24)	1.96 (1.80)
Pol anti-tetanus IgG (IU/mL)	n=50 9.22 (11.25)	17 (34.0) 10.67 (12.11)	33 (66) 5.26 (7.81)		NA	
Past history of anti-tetanus immunisation IgG (IU/mL)						
Baseline anti-tetanus IgG value**	No history (n=11) With history (n=37)	1.02 (1.51) 1.19 (2.67)	-		NA	
Anti-tetanus IgG value postimmunisation***	No history (n=11) With history (n=37)	9.40 (11.57) 8.69 (10.74)	-			

* $t = -3.21$; $P < 0.001$, ** $t = -0.456$; $P = 0.649$, *** $t = -0.196$; $P = 0.845$. BS: Baseline value of before immunisation, Pol: Post-immunisation anti-tetanus IgG level, NA: Not applicable

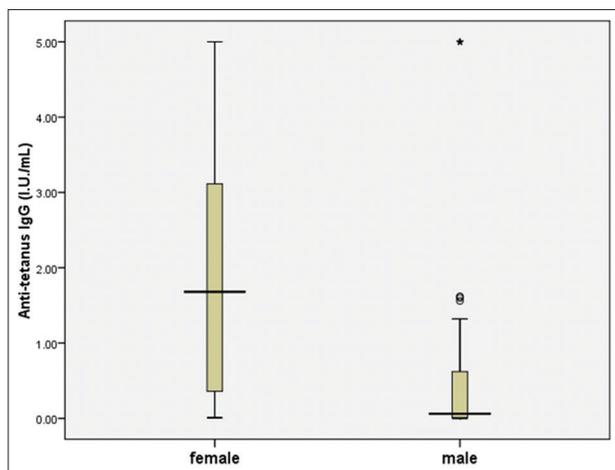


Figure 1: Comparison of mean serum levels of anti-tetanus IgG between females and females among controls at presentation ($t = -3.21$, $P = 0.002$)

post-immunisation also showed that the mean of serum levels of anti-tetanus IgG in males was 10.67 (12.11) IU/mL, higher the mean value of 5.26 (7.81) IU/mL in the females though the difference was not statistically significant ($P = 0.067$).

DISCUSSION

In this study, we found that the majority of the patients attended to were males; with a male to female ratio of 1.8:1. This confirmed that traumatic injuries are more common in males than females as previously reported.⁹ This has been associated with occupation-related and pattern of high-risk behaviours of males that predispose them to injuries requiring the need to seek intervention in the hospital.

Four weeks after receiving immunisation, <25% of the patients reported back for re-evaluation. This might not be unconnected with some level of poverty in many of our patients, as they were expected to pay some amount of fees before being attended to. This is in addition to transportation fees to and from the hospital in some cases. It has been shown that the removal of user fees significantly improved attendance in health facilities.¹⁰

The present study found a higher mean of baseline serum anti-tetanus IgG in the patients than in controls. This could be as a result of previous injuries in the patients, as the majority of them were male with occupational hazards and high-risk behaviours usually associated with injuries. Immunisation in women of child-bearing age during antenatal visits or immunisation following injuries might also be a factor.⁹ Further analysis of the data showed that the means of baseline serum anti-tetanus antibody level in both patients and controls were significantly higher in females than males. This was most likely due to the fact of previous anti-tetanus immunisation in women during antenatal visits.

By the international standard, a serum anti-tetanus antibody level above 0.1 IU/mL is considered protective.⁸ The present study showed that more than 50% of the controls

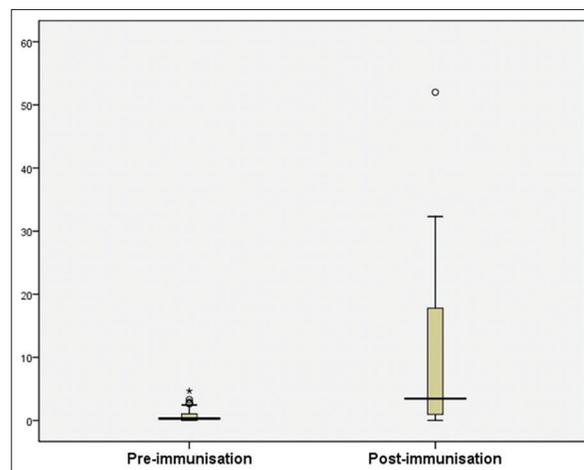


Figure 2: Comparison of pre- and post-immunisation serum anti-tetanus IgG levels among patients

and about 50% of the patients were not protected and required immunisation. This further underscores the need for continuing immunisation in our hospitals to avoid the consequences of poor immunity to tetanus infection. The present study also showed that 4 weeks after immunisation, patients had more than 8-fold rise in the mean of anti-tetanus antibody levels above the baseline levels. This was an indication that the immunisation was effective. The result after immunisation also showed that males had a better response to the tetanus toxoid than females. Immune responses to vaccines are said to differ between males and females. Stronger humoral responses in women have been found with influenza and hepatitis B virus, whereas pneumococcal polysaccharide vaccine showed stronger responses in males.¹¹ The results of the present study showed that immune response to tetanus toxoid was an example of a stronger response in males than females. It is also noteworthy that the mean of serum anti-tetanus IgG among patients who previously received anti-tetanus immunisation in the past was not significantly higher than those without a history of previous immunisation. This finding underscores the need for booster doses to provide adequate protection in all cases of open injuries, and in particularly if the injury is heavily contaminated and the risk of contracting tetanus is high, passive immunisation with anti-tetanus serum is advised.

CONCLUSION

The results of the present study suggest that many adults in Nigeria are not protected against tetanus. It is, therefore, recommended that anti-tetanus immunisation should be continued since there was a good response to TT immunisation in the majority of the patients. This should be followed with booster doses as stipulated by the WHO.¹²

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Conflicts of interest

There are no conflicts of interest.

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