

In the name of God

**Shiraz E-Medical Journal**  
**Vol. 11, No. 2, April 2010**

<http://semj.sums.ac.ir/vol11/apr2010/87029.htm>

**Assessment of Maternofoetal Transfer of Antitetanus Immunoglobulin G in Jos University Teaching Hospital (JUTH), Jos.**

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Received for Publication: August 25, 2008, Accepted for Publication: December 13, 2009.

**Abstract:**

**Introduction:** This study evaluates the coverage efficacy of the tetanus immunization programme in Jos University Teaching Hospital (JUTH), Nigeria and certain factors that affect the efficiency of maternofoetal transfer of tetanus toxoid (TT) IgG antibodies.

**Materials and Methods:** Sera from 43 mother-baby pairs selected randomly in JUTH were investigated for TT IgG antibodies using enzyme linked immune-sorbent assay (ELISA) technique. TT IgG antibodies were detected in 36 and 38 mothers and babies respectively.

**Results:** Thirty-six (83.7%) and 38 (88.4%) mothers and babies respectively were found to be seropositive (equivalent to or greater than 0.151IU/ml of TT IgG antibodies). Three (7.0%) seronegative mothers had seropositive babies. One (2.3%) seropositive mother had a seronegative baby. A highly significant correlation was observed between maternal and fetal TT IgG antibodies level ( $r=0.905$ ). Twenty-one (58.3%) of the 36 seropositive mothers had concentrations lower than their respective babies. The ratio of the mean concentrations of the TT IgG antibodies of cord blood to maternal blood (C/M ratio) was less than one. Maternofoetal transfer of TT IgG antibodies was found to be unrelated to the baby's gender, weight and the mode of delivery.

**Conclusion:** The study underscores the need to improve on the current immunization programme in JUTH and for further studies to understand how maternal characteristics affect the maternofoetal transfer of TT IgG antibodies in JUTH.

**Keywords:** tetanus toxoid, maternofoetal, placental, ELISA, Immunoglobulin G.

## **Introduction:**

Tetanus is a serious but preventable disease that affects the body's muscle and nerves. Tetanus toxoid has almost eliminated tetanus in developed countries where immunization is almost universal.<sup>(1)</sup> Ironically tetanus, especially neonatal tetanus (NNT) is however still a major problem in developing countries.<sup>(2)</sup> It was reported that tetanus, according to the World Health Organization (WHO) is the second most leading cause of death from vaccine preventable diseases among children worldwide.<sup>(3)</sup> In Nigeria, West Africa where this study was carried out, it was also reported that neonatal tetanus is a major cause of morbidity and mortality among neonates. Accordingly Nigeria has been listed as one of the twenty-seven countries in the world that account for ninety percent of the global burden of NNT.<sup>(4)</sup> The report concluded that every case of mortality arising from NNT is an embarrassment to the health care delivery system in Nigeria.

Several reasons ranging from unhygienic practices by traditional birth attendants to the inadequacies of the antitetanus immunization program have been advanced as the possible cause of the high incidence of NNT in developing countries.<sup>(5)</sup> The interplay of these factors exposes non-immunized mothers and their babies to the risk of tetanus infection during birth.

The main thrust of controlling infectious diseases, for example tetanus in very young infants in developing countries has been vaccination shortly before and/or after birth. However many vaccines administered at birth are either poorly immunogenic or contraindicated.<sup>(6)</sup> The pro-

tection of young infants depends to a large extent, therefore on the antibodies acquired passively from maternofetal transfer.<sup>(7)</sup> Vaccine related immunity to tetanus in adult is associated with the production of neutralizing IgG antibodies to tetanus toxoid<sup>(8)</sup> following exposure to the vaccines while the maternofetal transfer of IgG during the second and third trimester of pregnancy forms the basis of passive protection for the babies in the first months of life.<sup>(6)</sup> The protective antibody response after tetanus vaccination is defined as an antitetanus antibody level equal to or greater than 0.15IU/ml.<sup>(9)</sup>

The transfer of IgG antibodies across the placenta is an active process which requires IgG movement across the syncytiotrophoblast (involving fc receptors on the syncytiotrophoblast) and the endothelium.<sup>(10)</sup> The ability to respond to antigenic challenges is dependent on both host and antigenic factors.<sup>(11, 12)</sup> Several factors such as maternal concentration of IgG antibodies<sup>(13)</sup>, prematurity and low birth-weight<sup>(14)</sup> and gestational age of the newborn, intrauterine growth retardation IgG subclass levels<sup>(15)</sup> have been found to affect the efficiency of the transplacental transfer of IgG antibodies. The present study aimed to evaluate the coverage efficacy of the tetanus immunization programme in JUTH and the effects of the mode of delivery, baby's weight and the baby's gender on the efficiency of maternofetal transfer of TT IgG antibodies.

## **Materials and Methods:**

**Serum Samples:** A total of 86 subjects comprising of 43 mother-baby pairs were

selected randomly in the labor ward of the Jos University Teaching Hospital. The women were aged between 18 to 42 years. Other information sought includes mode of delivery, doses of tetanus toxoid received, baby's sex and weight. No active case of infection was recorded in any of the subjects. The neonates were classified on the basis of their sex, weight and the mode of delivery. Samples of maternal venous blood and neonates cord blood (on the foetal side of the baby) were withdrawn immediately after delivery, centrifuged and separated. The sera obtained were stored frozen at -200C for subsequent assay.

**Enzyme Linked Immunosorbent Assay**

**Technique:** Qualitative and quantitative determination of IgG class antibodies to tetanus toxin in serum were carried out using DIAGNOSTIC AUTOMATION tetanus toxin IgG ELISA kit, manufactured by DIAGNOSTIC AUTOMATION INC. California, USA. Sera were diluted by the sample diluents provided alongside the kit by the kit manufacturers 1: 100 dilution and then investigated for antitetanus IgG antibodies by enzyme linked immunosorbent assay technique using rabbit purified peroxidase labeled antihuman IgG antibodies conjugate, as directed by the manufacturer.

**Statistical Analysis:** This was done using Pearson correlation analysis and students T test at 95% level of significance. P-value is considered significant if less than 0.05 (P<0.05).



**Results:**

In this study, 36 mothers (83.7%) and 38 neonates (88.4%) of the 43 mother-baby pairs investigated showed seroprotective concentration of TT IgG antibody of greater than 0.15IU/ml.<sup>(9)</sup> In all, 75 subjects (87.2%) out of 86 subjects investigated were seropositive.

A highly significant correlation (r=0.905) was observed between the tetanus toxoid antibodies concentrations of the seropositive mothers and neonates.

21seropositive neonates had cord blood TT IgG antibodies concentrations that were higher than that of their respective mothers resulting in a "cord blood to maternal blood TT IgG antibodies concentrations" ratio of greater than one. This result represents a 58.3% efficiency of the active transfer of TT IgG antibodies in the mothers investigated.

Three seronegative mothers had seropositive neonates. The reverse was however the case in one seropositive mother who had a seronegative neonate.

Mode of delivery and the sex of the baby respectively were found to have no influ-

ence on the concentration of the antitetanus IgG antibodies transferred to the neonates investigated, ( $P > 0.05$ ).

All the babies investigated had normal birth weight.

#### **Discussion:**

Tetanus is still a major health problem in the developing countries of the world.<sup>(2)</sup> The best approach to the prevention of tetanus neonatorum (a leading cause of infant's deaths throughout the world) is the active immunization of women before or during pregnancy with tetanus toxoid.<sup>(16)</sup>

In JUTH where the present study was carried out, the major strategy for the prevention of tetanus include the provision of 5-doses of tetanus toxoid to all women of childbearing age as from first contact spanning a period of 31 months as recommended by the WHO.<sup>(17)</sup> All pregnant women who have not been immunized before their first contact at antenatal clinic (ANC) are administered two doses of tetanus toxoid before delivery.

In this study, which was carried out to investigate the coverage efficacy of the tetanus immunization programme in JUTH, percentage immunization coverage efficacy of 83.72% and 88.37% for mothers and neonates respectively was recorded.

The result of this study also revealed a significantly high TT IgG antibodies concentration in most of the seropositive mothers. Similarly, the placental transfer was high resulting in high concentration of TT IgG antibodies in most of the babies. A highly significant correlation was observed between the maternal and babies concentrations of TT IgG antibodies.

This result is consistent with the results of earlier findings reported by WHO and Wesuperuma et al.<sup>(19, 14)</sup> They reported that increasing doses of tetanus toxoid vaccines precipitate increase in the maternal tetanus toxoid IgG levels such that a corresponding increase in the neonatal tetanus toxoid IgG antibodies levels is similarly precipitated. This result however differs with the position earlier held by Demoraes-Pinto et al and Hood et al.<sup>(20, 18)</sup> They argued that high concentrations of maternal antibodies impair placental transfer.

Most of the babies had TT IgG antibodies concentrations higher than that of their respective mothers. Ironically however, the ratio of the mean concentration of the cord blood antitetanus IgG antibodies to the mean concentration of the maternal tetanus toxoid IgG antibodies (mean C/M) was less than one. It was observed that the high level of transplacental dilution in the babies that had lower concentrations of tetanus toxoid IgG antibodies than that of their respective mothers, which accounted for the low mean C/M ratio. This result suggests a serious flaw in the placental transfer of antibodies in those mothers, which agrees with the earlier findings of Hood et al.<sup>(18)</sup> They said that the possible mechanisms involved in blocking transplacental transfer of tetanus toxoid IgG antibodies might be high maternal IgG levels or damage to the placental architecture.

The concentrations of the babies TT IgG antibodies were not influenced by the mode of delivery of the infants which differs with the earlier positions of Stirrat and Kandil et al <sup>(21, 22)</sup> They suggested that uterine contraction in normal vaginal

delivery (NVD) enhances the milking of antibodies from maternal side to neonatal side. The process of IgG transfer begins in the first trimester of pregnancy and ends in the third trimester. It is possible for the process to culminate before the time of birth therefore making it independent of the birth process, whether by NVD or Caesarean Section (CS).

The gender of the babies had no influence on the concentrations of antibodies transferred. It is possible that since the gender of a baby is determined during fertilization and therefore not associated with intra-uterine development, it may not affect the transplacental transfer of antibodies.

#### **Conclusion:**

The present findings indicate the need for a greater mobilization of people in the campaign against tetanus in order to be able to meet the WHO target for the total elimination of tetanus/neonatal tetanus worldwide. Although the result of this study failed to confirm the influence of the mode of delivery, baby's gender and baby's weight on IgG transfer, but it however confirmed variation in the efficiency of transplacental transfer among the subjects. Extrinsic or intrinsic factors, whether maternal or neonatal, responsible for the variation in transplacental transfer observed in this study affect the efficacy of the immunization programme in JUTH and should be further investigated.

#### **Acknowledgement:**

The researchers acknowledged their indebtedness to the administration of Okene LGA (2007-2008) and the Nigerian

Ambassador to the people's republic of North Korea, Brig. Gen. Abubakar Amuda Yusuf (rtd) for their moral supports for this study.

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