

## ORIGINAL ARTICLE

**Tetanus Neonatorum: its Associated Risk Factors and Mortality Rate in Khyber Pakhtunkhwa**FARID ULLAH<sup>1</sup>, FARMAN ULLAH<sup>2</sup>, TAJ MUHAMMAD<sup>1</sup>, RIDA NAZ<sup>3</sup>, MUBARIK ALI<sup>4</sup>, NORINA JABEEN<sup>5</sup><sup>1</sup>Assistant Professor, Department of Pediatrics, Gomal Medical College Dera Ismail Khan<sup>2</sup>Associate Professor, Department of Pediatrics, Gomal Medical College Dera Ismail Khan<sup>3</sup>Regional Blood Centre, Dera Ismail Khan<sup>5</sup>Animal Science Institute, National Agricultural Research Center, Islamabad-54000-Pakistan<sup>6</sup>Rural Sociology Department, Institute of Social Sciences, University of Agriculture Faisalabad, PakistanCorrespondence to: Rida Naz, Email: [dr.ridaanaz@gmail.com](mailto:dr.ridaanaz@gmail.com)**ABSTRACT****Background:** Tetanus neonatorum is a preventable cause of mortality and neurological sequel that is more prevalent in resource-poor nations, perhaps because to low rates of mother immunization and unclean cord care procedures.**Objectives:** The study was conducted in different districts of Khyber Pakhtunkhwa to investigate the prevalence of tetanus neonatorum, its associated risk factors and mortality rate.**Methods:** This was a retrospective study conducted in five districts of Khyber Pakhtunkhwa during the year 2020-22, through evaluation of the hospital records of 185 tetanus infected neonates, for the assessment of acute risk factors and clinical outcome of the infection.**Results:** It was found that a significantly higher proportion ( $p < 0.05$ ) of the infected were neonatal fetuses of age less than ten days with the incidence of 83.24%. High mortality rate of 31.35% was observed in the infected infants in which 58 out of 185 infected infants did not survive. Most of the infected patients ( $p < 0.05$ ) were born at home (129/185), through vaginal birth (104/185) and delivered in unhygienic environment (156/185). A significantly high number of women were not immunized against the tetanus infection ( $p < 0.05$ ) and fetal umbilical cords were not managed aseptically and were cut with used razors (12.97%) and fastened with unhygienic threads (38.37%), rendering them vulnerable to the fatal infections.**Conclusion:** It was concluded that poor tetanus toxoid immunization of the mothers and unhygienic conditions were likely causes.**Keywords:** Deep wounds; Immunization; Umbilical cord; Unhygienic deliveries.**INTRODUCTION**

Neonatal tetanus (NT), commonly termed as tetanus neonatorum, is a bacterial disease that affects small infants born to unvaccinated mothers. It is a kind of global tetanus, caused by *Clostridium tetani's* exotoxin tetanospasmin, which prevents the release of inhibitory neurotransmitters (i.e., disinhibition). The primary cause is contamination of the umbilical cord stump. Typical early symptoms include weakness and inability to suckle, followed by risus sardonicus, trismus, and eventually generalized tetanic spasm, opisthotonus and rigidity. Without treatment, the fatality rate for newborn tetanus exceeds 90 percent. Asphyxia may end in death due to spasms and hyper-sympathetic conditions. The management goals aimed to neutralize tetanospasmin, eliminate C. tetani, treat the wound and provide supportive care, including mechanical breathing, sedation, parenteral feeding, neuromuscular blockade and control of autonomic dysfunction<sup>1</sup>.

The most common cause of NT is using non-sterile procedures to cut the umbilical cord, using non-sterile conventional treatments to the umbilical cord stump; however, infection of the umbilical stump is not always apparent. Risk factors for maternal and neonatal tetanus include deliveries performed by individuals with unclean hands or on contaminated surfaces. It is not contagious but is a highly fatal infection. In 2015, 34,000 NT fatalities were reported worldwide. The disease remains a significant threat to global public health, particularly in regions with high infant mortality among world's poorest nations<sup>2</sup>.

Pakistan is one of the developing nations that have yet to eliminate neonatal tetanus. The key to success is vaccination combined with clean delivery methods and completes population access. It was reported that unclean cord care procedures, home birth and the educational level of the mother, are significant risk factors for this condition. Maternal and Neonatal Tetanus (MNT) can therefore be eradicated if the two key variables of low coverage and mother's attendance by a skilled health professional are attained. Approximately 99 percent of NTs and deaths occur in low- and middle-income countries due to a variety of causes, among which NT contributes to less than one percent, despite being easily preventable through effective surveillance, risk categorization and timely interventions<sup>3</sup>.

Therefore, this study was conducted in different districts of Khyber Pakhtunkhwa to investigate the prevalence of tetanus neonatorum, its associated risk factors, mortality rate and case fatality rate.

**MATERIALS AND METHODS**

This was a retrospective study conducted in five districts of Khyber Pakhtunkhwa viz Peshawar, Abbottabad, Mardan, Swat and Dera Ismail Khan, during the year 2020-22 (02 years), through evaluation of the hospital records in the districts. A total of 185 patients data was retrieved who were affected with tetanus infection. The patient profiles, their demographic characteristics, clinic-pathological investigations, outcome, risk factors and mortality rate were investigated.

NT was screened out through characteristic clinical features, history and bacterial culture. In addition to obtaining general information about the mothers, details of their perinatal history and antenatal care, including tetanus immunization, mode and place of delivery, the personnel conducting the delivery, instruments used to cut the umbilical cord, and materials applied to the cord stump, were collected<sup>4</sup>.

The inclusion criteria was based on the selection of infants from two months age, who survived the neonatal period, and whose mothers had no history of tetanus vaccination. We excluded infants from the mothers with a history of one or more doses of TT because these putative risk factors could have been obscured through passive immunity transferred from mother to child.

The data was collected, compiled and statistically analyzed by employing SPSS 24 software. Chi square tests were employed to compare the means within the treatments. A p-value less than 0.05 were considered statistically significant, keeping the confidence intervals at 95%.

**RESULTS**

This was a retrospective study conducted in five districts of Khyber Pakhtunkhwa during the year 2020-22, through evaluation of the hospital records of 185 tetanus infected infants. The patient profiles and their demographic characteristics revealed that most of the affected infants were males (97/185) followed by females

(88/185) with a frequency of 52.43 and 47.56%, respectively and non-significant ( $p>0.05$ ) difference was found in the gender of infected infants. But significantly higher proportion ( $p<0.05$ ) of the infected were neonatal fetuses of age less than ten days with the incidence of 83.24%. The data regarding the maternal and paternal educations of the neonates were also collected to assess their educational capabilities and awareness regarding the infections, whereby most of the fathers and mothers were educated ( $p<0.05$ ) with the frequency of 77.29 and 62.70%, respectively. The prevalence of tetanus neonatorum was significantly high in rural population ( $p<0.05$ ) than urban with the rate of 72.29 and 62.70%, respectively (Table 1).

Table 1: Demographic characteristics of study population

S. No	Variable	No. of subjects (n)	Frequency (%)	$\chi^2$	p-value
1	Sex			0.2028	0.6525
	Male	97	52.43		
2	Age (days)			55.94	0.00001*
	<10 days	154	83.24		
3	Weight (Kg)			1.6686	0.1964
	<3.5 Kg	81	43.78		
4	Maternal Education			7.5142	0.0061*
	Educated	116	62.70		
5	Paternal Education			36.89	0.00001*
	Educated	143	77.29		
6	Location			24.48	0.00001*
	Rural	134	72.43		
	Urban	51	27.56		

\*indicated that the p-value is significant at  $p<0.05$

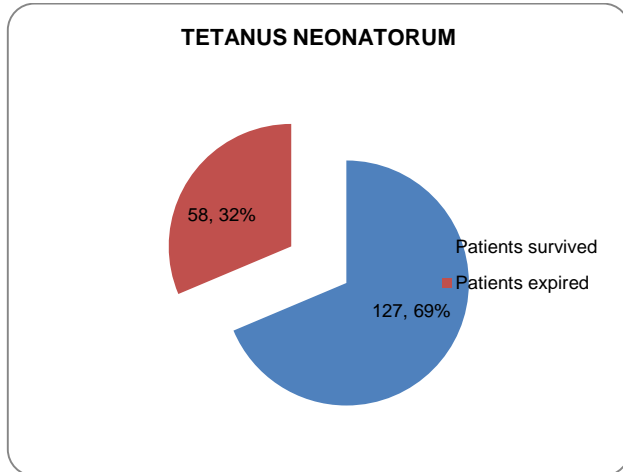


Figure 1: Recorded mortality rate in the infants due to tetanus neonatorum

High mortality rate of 31.35% (case fatality rate) was observed in the infected infants in which 58 out of 185 infected infants did not survive (Figure 1). The assessment of the tetanus neonatorum was done with the potential and significant risk factor of delivery in the mothers of subjects and the results revealed that most of the infected patients ( $p<0.05$ ) were born at home (129/185), through vaginal birth (104/185) and delivered in the unhygienic environment (156/185). However, most of the deliveries were performed through trained medical professionals ( $p<0.05$ ) (Figure 2). Immunization was also the key risk factor in this malady and therefore, data pertaining to the immunization status of the mothers was collected on the specimen Performa. The findings revealed that a significantly high number of women were not immunized against the tetanus infection ( $p<0.05$ ), followed by the immunized mothers with a single and double shots of the vaccine administration with the frequency of 55.13, 38.91 and 5.94%, respectively (Figure 3). The fetal umbilical cord was also one of the

high risk factor due to the creation of deep wound post-partum with the potential risk of entrance of Clostridium bacteria. It came to the knowledge that a huge number of neonates were unhygienically managed and their umbilical cords were cut with used razors (12.97%) and their cords were fastened with unhygienic threads (38.37%), rendering them vulnerable to the fatal infections (Figure 4).

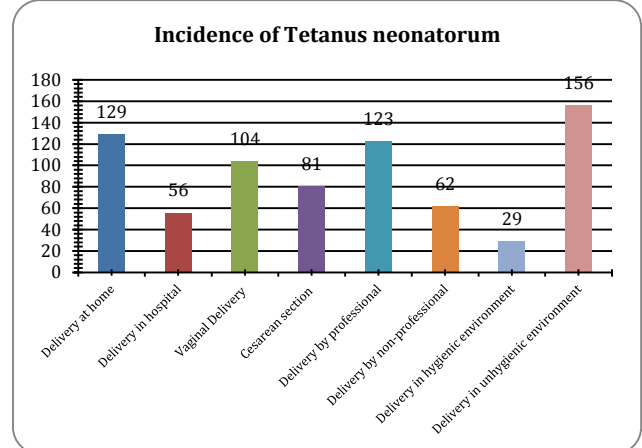


Figure 2: Assessment of the delivery status of the infant's mother as a potential risk factor for Tetanus neonatorum

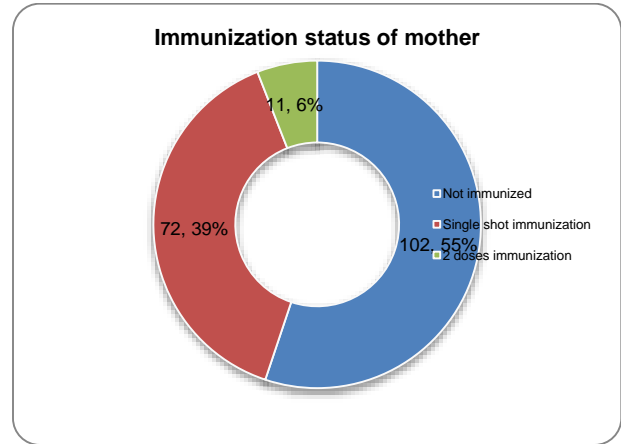


Figure 3: Immunization status of the fetal mother

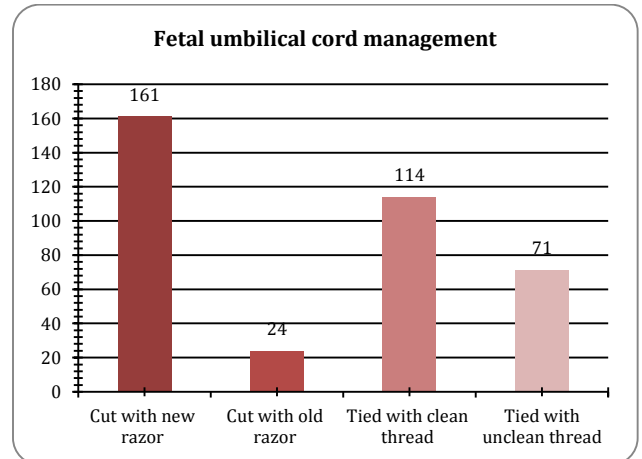


Figure 4: Assessment of fetal umbilical cord as a potential risk factor for Tetanus neonatorum

## DISCUSSION

Tetanus neonatorum is a preventable cause of mortality and neurological sequelae that is more prevalent in resource-poor nations, perhaps because of low rates of mother immunization and unclean cord care procedures<sup>5</sup>. This study assessed the incidence, risk factors and consequences of NT based on hospital admissions in the different districts of Khyber Pakhtunkhwa over two years. A high mortality rate of 31.35% (case fatality rate) was observed in the infected infants and the major risk factors were unhygienic measures during the procedures of delivery, post-partum management and especially the cutting and fastening the umbilical cords of the fetuses. Similar findings were revealed in a study with the report that maternal and neonatal tetanus claimed 180,000 lives per annum, virtually entirely in underdeveloped nations. Although easily preventable by maternal vaccination with tetanus toxoid vaccine and aseptic obstetric and postnatal umbilical cord care procedures, maternal and neonatal tetanus continue to be a public health issue in 48 countries, primarily in Asia and Africa<sup>6</sup>. Our findings were significantly corroborated by a Pakistani study which found that NT was responsible for 18–38% and 17–22% of all newborn and infant fatalities, respectively. NT had a high case fatality ratio, and community-based surveys in developing nations revealed that, despite treatment, case fatality rates were increasing to 80-90%<sup>7</sup>.

Our findings were supported by a 1997 study conducted in the Loralai District of Pakistan, which indicated that NT was responsible for 23 deaths per 1000 newborns. Moreover, a high prevalence of NT infection was observed in births aided by untrained personnel (86%), unsanitary pre- and post-partum procedures, and inadequate tetanus toxoid vaccination (5%)<sup>8</sup>. The reported global death rate was 66.3%. The group who survived had a much higher admission mean body weight and a later onset of sickness and were hospitalized early. In the fatal group, risus sardonicus, generalized rigidity, fever, recurrent infections, and respiratory arrest were substantially more prevalent. Although hospitalization for NNT, maternal education and socio-economic place of families have enhanced over the past seven years, there is still a lack of indulgence regarding antenatal care. Births are still handled un-hygienically by untrained individuals<sup>4</sup>. A similar nature study also concluded that poor immunization and poor hygiene were the significant risk factors for NT<sup>9</sup>.

A study indicated that significant NT mortalities were reported from poor economic countries owing to the unavailability of advanced therapeutic methods, i.e. invasive breathing and neuromuscular blockade. This high death rate has been documented most frequently in infants whose symptoms began within the first week of life. Early disease onset may be owing to increased *C. tetani* bacterial inoculates and younger newborns were physiologically at high risk of death<sup>10</sup>.

Our findings were consistent with the study conducted in Punjab, Pakistan. Out of 176 recorded cases, 145 (82.3%) originated in rural parts of Punjab. The average age was 9 days, and there were 65 (37%) females and 111 (63%) males. The overall maternal death rate was 77 (43.6%), whereas 31 (17.6%) births were performed by unskilled birth attendants. The children that did not survive shared a number of clinical characteristics, including widespread stiffness, fever, and respiratory arrest<sup>11</sup>. In another investigation, the overall case fatality rate was 75%. Low birthweight, short incubation period, short period of onset, delay in seeking medical assistance, presence of comorbidities, dose of tetanus immunoglobulin 250 IU, and unclear entry site of infection determined mortality in these patients. Gender and delivery location were not related with an increased risk of mortality<sup>12-13</sup>. The leading causes of pre-discharge neonatal mortality were respiratory and cardiovascular diseases (43%) and low birthweight and prematurity (33%). The main maternal conditions that attributed to these deaths were complications of the placenta and cord, complications of pregnancy, \sand medical and surgical disorders. Low birthweight and premature birth accounted for 42% of neonatal deaths that occurred after discharge<sup>14-17</sup>.

Accurately diagnosing and reporting neonatal fatalities is the first step in assessing the magnitude and etiology of these significant events and predicting their risk factors. To reduce perinatal morbidity and death and enhance survival for preterm infants and other high-risk newborns, a strategy for a regionalized and coherent perinatal network should be created<sup>18</sup>. Data on mortality should be accessible by geographic region, rural or urban status, place of death, timing, underlying cause, as well as socioeconomic level. This can aid stakeholders in identifying priorities and monitoring progress<sup>19-20</sup>.

## CONCLUSION

It was concluded from our findings that poor tetanus toxoid immunization of the fetal mothers and the use of unsterile razors and umbilical cord fastening threads were likely causes. Principal risk factors were a lack of awareness, lack of immunization and unhygienic childbirth procedures. Enhancing prenatal care, boosting TT vaccine coverage, and increasing community awareness were highly recommended. Additionally, the deliveries may be conducted through trained medical professionals in the aseptic environment to curtail the incidence of this fatal but preventable malady.

**Conflict of Interest:** None

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