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STUDY ON THE MORTALITY FROM TETANUS NEONATORUM IN PAKISTAN

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Abstract:

Introduction: Neonatal tetanus (NT), caused by *Clostridium tetani*, is a highly fatal infection of the neonatal period. Infection occurs when the umbilical cord becomes contaminated as a result of unclean childbirth or cord-care practices. **Aims and objectives:** The basic aim of the study is analysis and study on the mortality from tetanus neonatorum in Pakistan. **Material and methods:** This study was conducted at Services Institute of medical sciences, Lahore during 2018. We conducted a community-based cross-sectional survey. To calculate the necessary sample size to estimate NNT mortality, we assumed an NNT mortality rate of 20 per 1000 live births. This assumption was based on information from the 1990–1991 Maternal and Infant Mortality Survey, Punjab, which showed a neonatal mortality rate of 66.4/1000 live births in Punjab. **Results:** The comparative epidemiological analysis of NT in Pakistan allowed us to evaluate the following: commonly identified risk factors for NT, their relevance to MNT elimination strategies, NT mortality levels and trends, the impact of TT immunization on NT mortality, and the role of surveillance in monitoring disease control efforts. **Conclusion:** It is concluded that Low immunization coverage with TT and low antenatal care suggest deficiencies of the maternal and child health services and Expanded Program on Immunization (EPI) in this area.

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INTRODUCTION:

Neonatal tetanus (NT), caused by *Clostridium tetani*, is a highly fatal infection of the neonatal period. Infection occurs when the umbilical cord becomes contaminated as a result of unclean childbirth or cord-care practices. If contamination occurs when the cord is cut or within the next few days, symptoms begin 3-12 days after birth. The determinants of the incidence of NT relate to the cultural diversity of hygienic childbirth practices and cord care, parent's illiteracy, lack of antenatal care, including low level of immunization against tetanus, seasonality, geographical location and climate, prevalence of spores of *C.tetani* and rural agricultural settled populations. On the other hand, the determinants of mortality in NT are not well understood. Previous studies have shown that a short incubation period and low birth weight are associated with a high mortality rate and are poor prognostic indicators [2].

Neonatal tetanus, caused by *Clostridium tetani*, is the second leading cause of death from vaccine-preventable diseases among children world-wide. Globally, an estimated 248 000 neonatal deaths were caused by neonatal tetanus (NNT) during 1997. Almost 11% (26 400) of these NNT deaths were in Pakistan with an NNT mortality rate of 5 per 1000 live births. Neonatal tetanus is one of the most underreported diseases and its estimated mortality rate varies widely from country to country and within countries. Therefore it is important to identify the high-risk areas by defining magnitude of the disease in different parts of a country [3].

NT remains a public health problem in many developing countries including Pakistan, where it is one of the major causes of neonatal and infant mortality. In Pakistan, NT accounts for 18-38% and 17-22% of all neonatal and infant deaths respectively. NT has a high case fatality ratio (CFR) and community-based surveys in developing countries have reported CFRs approaching 80-90% even with treatment [4]. There is a dearth of reliable information on NT incidence and mortality from rural areas where most NT cases and deaths occur. We perceive that there are important gaps in quantitative analysis of NT surveillance data and reporting in rural Pakistan to inform decision-makers who must plan and implement control measures for neonatal tetanus elimination [5].

Background of the study

In Pakistan, the magnitude of the disease and the risk factors vary across geographical regions within the country. Wrapping of the neonate in sheep's skin, use of straw as the delivery surface and application

of *Ghee* (clarified butter) to the umbilical stump have been identified as risk factors in the northern areas of the country, while application of antimicrobials to the umbilical cord had a protective effect in a study from the province of Punjab. These findings suggest a diversity of birth practices enhance the risk of NNT in different regions of Pakistan and suggest different ways are needed to augment the effectiveness of the NNT elimination programme [6].

Aims and objectives

The basic aim of the study is analysis and study on the mortality from tetanus neonatorum in Pakistan.

MATERIAL AND METHODS:

This study was conducted at Services Institute of medical sciences, Lahore during 2018. We conducted a community-based cross-sectional survey. To calculate the necessary sample size to estimate NNT mortality, we assumed an NNT mortality rate of 20 per 1000 live births. This assumption was based on information from the 1990–1991 Maternal and Infant Mortality Survey, Punjab, which showed a neonatal mortality rate of 66.4/1000 live births in Punjab. Since NNT is one of the leading causes of neonatal mortality in Pakistan, we assumed that at least 30% of the neonatal deaths in Punjab could be due to NNT, leading to an estimated NNT mortality rate of 20 per 1000 live births. In the analysis, we computed the estimate for NNT mortality with its 95% CI. We obtained information on possession of household assets and ownership of agricultural land and animals as proxy indicators of wealth. We assigned the average current market price to each household item, unit of agricultural land and animal.

Statistical Analysis

Statistical analyses (Anova Test and Post Hoc) were performed using the SPSS software program (17.0). All results were expressed as the mean \pm standard deviation (SD). P value below 0.05 was considered to be statistically significant.

RESULTS:

Comparative studies of neonatal tetanus in Pakistan

The comparative epidemiological analysis of NT in Pakistan allowed us to evaluate the following: commonly identified risk factors for NT, their relevance to MNT elimination strategies, NT mortality levels and trends, the impact of TT immunization on NT mortality, and the role of surveillance in monitoring disease control efforts. The literature search yielded 29 original articles that allowed direct comparison because they were all carried out in different areas of Pakistan, used a

similar case definition of NT for case ascertainment, and had similar control populations, if provided. Excluding case series and case reports, we identified nine case-control studies, nine cross-sectional

studies, three community-based mortality surveys, two quasi-randomized trials, four descriptive studies, one community-based randomized trial, and one prospective cohort study (table 01).

Table 1: Comparative studies of neonatal tetanus in Pakistan

Place	Sample size (number of cases, number of controls)	Main findings	Ref.
Case-control studies			
NWFP	69 cases, 207 controls	Application of ghee to wound stump, PAR ^a % = 43	⁰⁵
NWFP	102 cases, 306 controls	Application of ghee made in home from cow's milk (OR 1.94, 95% CI 1.07–3.53) Non-academically trained delivery attendants (OR 3.90, 95% CI 1.02–14.88)	⁰⁶
Peshawar, NWFP	100 cases, 300 controls	In-use of ghee during the first few days of life (OR 1.76, 95% CI 1.02–3.1)	⁰⁷
Rural parts of the northern areas of Pakistan	354 (59 cases, 295 controls)	Bundling within the first 3 days of life (OR 2.5, 95% CI 1.3–4.9); PAR% = 23	⁰⁷
Rural parts of Punjab Province	211 cases, 633 controls	Interaction of pre-delivery exposure of mothers to ghee and delivery on a surface prepared with dried cow dung (OR 5.8)	⁰⁸
Punjab Province	133 cases, 399 controls	The lack of topical antibiotics in circumcision wounds is a significant risk factor of NT (OR 4.2, 95% CI 1.4–12.6)	⁰⁹
Rural areas of Punjab Province	229 cases, 687 controls	Ghee applications to umbilical wounds when heated with cow dung fuel was significantly associated with NT (OR 2.7, 95% CI 1.1–6.6)	⁴⁸
Loralai District, Balochistan Province	41 cases, 123 controls	Risk factors were use of soil as delivery surface (OR 3.2, 95% CI 1.1–10.2) (PAR% = 64), father's illiteracy (OR 3.2; 95% CI 1.3–8.1), and possession of sheep at home (OR 2, 95% CI 1.0–5.0)	¹⁰
Karachi, Sindh Province	125 cases, 250 controls	Application of substances on umbilical cord (OR 5.1, 95% CI 2.7–9.7) (PAR% for subsequent cord application = 69), home delivery (OR 1.8, 95% CI 1.1–3.1) (PAR% = 31), and illiterate mother (OR 1.6, 95% CI 1.0–2.0)	¹¹

Table 02 shows the basic characteristics of local population of Punjab. It shows the univariate analysis of risk factors for neonatal tetanus mortality

Table 2: Univariate analysis of risk factors for neonatal tetanus mortality

Risk factor	Frequency among		Matched odds ratio and 95% CI	
	Cases % (n = 41)	Controls % (n = 123)		
^a Reference category.				
^b Clarified butter (<i>Ghee</i>) and an Antimony preparation locally termed as ' <i>Surma</i> '.				
Paternal illiteracy	78	58.5	2.6 (1.1–7.0)	
Possession of sheep at home	63	45.5	2.2 (1.0–5.2)	
Male infant	41.5	44	1.1 (0.5–2.4)	
Paid fee for delivery services	45.5	71	0.30 (0.1–0.7)	
>2 pregnancies in last 3 years	24	9	3.2 (1.1–9.4)	
Delivery attendant				
Doctor/lady health visitor/traditional birth attendant ^a				
Relative	59	40	2.4 (1.02–5.7)	
Economic status				
>US\$2200 ^a				
US\$1100–2200	48	54	0.9 (0.3–3.5)	
<US\$1100	36	27	0.7 (0.4–13.0)	
Delivery surface				
Plastic/bed sheet ^a				
Soil	85	62	4.0 (1.4–14.0)	

DISCUSSION:

NT is a reportable disease in Pakistan and it is reported separately from other tetanus cases. Pakistan has made rapid progress towards the elimination of NT. To address the global NT elimination goal of reducing the NT incidence to <1 case/1000 live-births in every district in Pakistan, there is the need for better population-based data on the completeness of reporting of NT, incidence, and analysis to inform decision-makers who must plan and implement control measures for NT elimination [9]. However, an assessment of the completeness of ascertainment of disease reporting systems for NT is difficult for several reasons. First, most NT deaths occur at home, with birth and death not reported. Second, we do not know the proportion of NT cases for whom health care is sought. And third, despite underreporting, the true number of NT cases in the community is not known [10]. Although the incidence rates reported in one study are below the global elimination goal, the surveillance data suggest substantial underreporting, as the number of cases and NT incidence rates vary from one geographical area of a district to another.

In Pakistan, not much has been done using community informants and village volunteers to report suspected NT cases and other vaccine preventable diseases. Using health volunteers to report a communicable disease outbreak has been shown to be effective in Cambodia [13]. The LHW program of the National Programme for Family Planning and Primary Health Care has been found to

be effective in delivering family planning and immunization services, as well as the management of diarrhea. The success of the LHW program is primarily due to the unlimited access to households, free interaction with local women, and most importantly the acceptability of LHWs in the communities.

CONCLUSION:

It is concluded that Low immunization coverage with TT and low antenatal care suggest deficiencies of the maternal and child health services and Expanded Program on Immunization (EPI) in this area. In order to achieve the goal of NNT elimination in developing countries like Pakistan, it is important to alter the environmental conditions during the delivery by changing birth practices and improving immunization coverage with tetanus toxoid.

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