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In-Hospital Mortality among Patients of Severe Adult Tetanus Presenting with bad Prognostic Factors: A Tertiary Care Hospital Experience

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ABSTRACT

Background: Tetanus caused by clostridium tetani, despite being a preventable disease, is still posing a significant health hazard to developing countries like Pakistan.

Objective: To determine in-hospital mortality among patients of severe adult tetanus presenting with bad prognostic factors.

Material and Methods: This cross-sectional study was conducted at the Department of Medicine, Medical Teaching Institution Lady Reading Hospital, Peshawar, Pakistan from July 13, 2017, to January 13, 2018, on 176 patients. All severe adult tetanus patients as per Ablett Classification with bad prognostic factors (incubation period <7 days, persistent fever >40° C, persistent tachycardia of >120/min, and no history of post-exposure prophylaxis) were included in the study. Patients with compromised renal functions (urea >108 mg/dl, reduced urine output <50 ml/hr) and already diagnosed neuromuscular junction disorders were excluded from the study. Written informed consent was obtained and patients were enrolled in the study. All patients were immediately worked up with detailed history and clinical examinations and were managed as per ICU protocols and followed within the hospital for mortality.

Results: Mean age of study participants was 47±10.27 years. The majority of study subjects were males (n=102, 58%), un-immunized (n=88, 50%) or partially immunized (n=26, 15%), socioeconomically poor (n=84, 48%), illiterate (n=82, 47%) and from urban areas (n=114, 65%). In-hospital mortality was recorded in 109 (62%) of the study subjects. In hospital mortality was recorded highest in patients with an age range of 41-65 years (n=70/109, 64.22%), males (n=63/109, 57.8%), unimmunized (n=55/109, 50.45%), poor (n=52/109, 47.7%), illiterate (n=51/109, 46.78%) and urban (n=71/109, 65.14%).

Conclusion: In-hospital mortality was high in patients with severe adult tetanus presenting with bad prognostic factors.

Keywords: Clostridium tetani, Hospital Mortality, Severe adult tetanus, Tetanus, Tetanus Antitoxin, Tetanus Toxoid, Trismus, Prognostic Factors,

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INTRODUCTION

The word tetanus is derived from the Greek terminologies tétanose and tetanein, which means to stretch.[1] Tetanus is a disease of the nervous system that leads to muscle spasms and occurs due to anaerobe clostridium tetani, mostly found in soil.[2] The toxin named tetanospasmin produced by Clostridium tetani intoxicates the central nervous system and leads to spasms and other exacerbations. [3] Prevalence of tetanus has declined significantly in developed countries but the developing countries are yet at risk, particularly unvaccinated, uneducated, and unaware population groups. Although it is not possible to completely eradicate the spores of Clostridium tetani from the environment, better vaccination strategies and improved wound care management can significantly reduce its disease burden.[1]

Annually around 1 million cases of tetanus have been reported, mostly in underdeveloped countries.[1,4] People in their old age are more prone either due to the fact they are not immunized primarily or did not get their booster doses recommended at their age.[5] In contrast, Roper MH et al reported neonates in developing countries to be at more risk of death due to tetanus.[6] Tetanus is a life-threatening disease of the third world and requires modern technology, as heavy sedation and ventilator support are the mainstays of management, and these facilities are not readily available in developing countries in which the disease is prevalent.[7] Case fatality ratio of tetanus ranges from 20%-50%, and it can be brought to lower percentages provided a robust vaccination program implements and standards of wound care are improved in providing health care to the

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patients.[8] Its severity is classified into mild, moderate, and severe on clinical grounds.[9] Advancing age of a patient, type, and nature of the injury, time of incubation period, delayed post-exposure prophylaxis, and Delaying treatment influenced mortality in tetanus patients significantly.[9,10] In mild and moderate tetanus, the reported mortality rate was 6%, while the rate was 10 times higher in severe tetanus up to 60%.[11] Woldeamanuel et al., reported a case fatality rate of 43.2% (95%CI 36.9%-49.5%) in adult tetanus patients of Africa. The prognosis for tetanus is largely dependent on the various clinical prognostic factors.[12] Incubation period of <7 days is correlated with increased mortality (58-75%). Mortality in tetanus patients was highly correlated with generalized spasms in tetanus, fever higher than 40°C, and tachycardia more than 120 beats/min.[12,13]

Tetanus can be detrimental if not taken abruptly measures for treatment. Common etiologies are road traffic accidents, un-sterilized surgeries, the use of injections, and burn wounds. The current study was designed to determine the in-hospital mortality among patients with adult severe tetanus and having a predefined set of bad prognostic factors. To the best of our knowledge, this type of study has not been conducted in our local population with severe tetanus.[14]

MATERIAL AND METHODS

It was a descriptive (cross-sectional) study conducted at Lady reading hospital from July 2017 to January 2018. Ethical approval was granted by the ethical review board at Medical Teaching Institution Lady Reading Hospital, Peshawar, Pakistan. We enrolled 176 patients via non-probability convenient sampling techniques as per WHO sample size using a mortality proportion of 34%,[12,13,15] confidence interval of 95%, and a margin of error of 7%. All patients of severe adult tetanus with bad prognostic factors[9] (incubation period <7 days, persistent fever >40°C, persistent tachycardia of >120/min, and no history of post-exposure prophylaxis) were enrolled between the age of 18 and 65 years. Patients with compromised renal functions (urea above 108 mg/dl and reduced urine output of less than 50 ml/hr) were excluded from the study. Patients with already diagnosed neuromuscular junction disorders like myasthenia gravis and Lambert-Eaton syndrome were also excluded from the study. The purpose and benefit of the study were explained to all patients/guardians and written informed consent was taken. All baseline workup was obtained from the hospital laboratory and treatment was given as per ICU protocol with ventilators, intravenous diazepam, and antibiotics.

All the data collected were analyzed through Statistical Package for Social Sciences (SPSS) version 21. Frequency and percentages were calculated for categorical variables like gender, the status of examination, socioeconomic status, location of the patients, and in-hospital mortality. The mean and standard deviation for the age was calculated. In-hospital mortality was stratified for age, gender, status of immunization, socioeconomic status, education level, and location of the patient to see the effect modification. Post-stratification chi-square test was applied in which a p-value of <0.05 was taken as significant.

RESULTS

Mean age of study participants was 47±10.27 years. The majority of study subjects were males (n=102, 58%), un-immunized (n=88, 50%) or partially immunized (n=26, 15%), socioeconomically poor (n=84, 48%), illiterate (n=82, 47%) and from urban areas (n=114, 65%) as presented in Table 01. In-hospital mortality was recorded in 109 (62%) of the study subjects. In hospital mortality was recorded high in patients with age range of 41-65 years (n=70/109, 64.22%), males (n=63/109, 57.8%), unimmunized (n=55/109, 50.45%), poor (n=52/109, 47.7%), illiterate (n=51/109, 46.78%) and urban (n=71/109, 65.14%) as shown in Table 02.

DISCUSSION

Although tetanus can not be eradicated due to its widespread prevalence of spores in the environment but Tetanus is a preventable disease with immunization of three booster doses at least in adolescents.[12,13,15,16] at this moment only women of childbearing age are targeted with immunization during pregnancy which has reduced both maternal and neonatal burden of the disease. However, disease prevalence in adults in South Asia and sub-Saharan Africa is still a problem. A study conducted in 2017 by Global Burden of Disease (GBD) showed that up to 82% of disease burden and 77% of disease mortality of 38000 tetanus deaths were found in these two regions.[12,15,16]

Table 01. Demographic Details of the Study Subjects (n=176)

Variables		Frequency	Percentage
Age (years)	20-30	26	14.77%
	31-40	37	21.02%
	41-50	58	32.95%
	51-60	55	31.25%
Gender	Male	102	57.95%
	Female	74	42.05%
Immunization Status	No immunization	88	50.0%
	Immunization <5 years	26	14.77%
	Immunization >5 years	62	35.23%
Socioeconomic Status	Poor (monthly income < 15000 PKR)	84	47.73%
	Middle class (monthly income 15000-30000 PKR)	60	34.09%
	Rich (monthly income > 30,000 PKR)	32	18.18%
Educational Status	Illiterate	83	47.16%
	Secondary	63	35.80%
	Graduate	30	17.05%
Residential Status	Urban	114	64.77%
	Rural	62	35.22%
In Hospital Mortality	Yes	109	61.93%
	No	67	38.07%

Our present study showed a higher case fatality compared to European countries with up to 62% in severe adult tetanus. The mean age was 47±10.27 years while the largest affected age group was between 41 to 65 years. One reason for more old-age involvement could be declining immunity levels with the advancing age of both immunized and unimmunized adults.[17]

Out of 176 patients 58% were males and people with a lack of education, lack of immunization, and lower socioeconomic status were more affected. Male predominance could be explained due to better immunization programs for women in their childbearing age and no such immunization programs for men. Although the current extended program for immunization vaccination program for males is only available in childhood and lacks adult boosters of the vaccine. Had there been an extended booster plan for all these children when grow into adolescence, the situation would have been different. Healthcare authorities should consider a booster dose program for all adults or at least for those identified as high risk for tetanus. The conventional dose of tetanus immunoglobulin is 2500-300 IU but studies show that the dose of 500 IU is as effective as the conventional dose.[18] One such high-risk population of farmers and agriculturalists is already identified by Oncu ss et al[18] where farmers of low to middle-income countries were found more at risk of getting tetanus as most of them work barefoot. The situation in our country is no different and with proper education of these exposed professions and awareness programs we can significantly reduce tetanus prevalence and mortality in our farmers and laborers. Also more involvement of lower income groups where most of the people were laborers and farmers explains the hazard of exposure too.

In-hospital mortality was recorded in 109 (62%) of the study subjects in the present study (Table 02). Mortality of 6 % was reported in mild to moderate

Table 02. Stratification Of In Hospital Mortality with Age, Gender, Immunization Status, Socioeconomic Status, Educational Status and Residential Status

Variables		In Hospital Mortality			P-value
		Yes	No	Total	
Age (years)	20-30	16	10	26	0.9999
	31-40	23	14	37	
	41-50	36	22	58	
	51-65	34	21	55	
	Total	**109**	**67**	**176**	
Gender	Male	63	39	102	0.9572
	Female	46	28	74	
	Total	**109**	**67**	**176**	
Immunization Status	No immunization	55	33	88	0.9878
	Immunization <5 yrs	16	10	26	
	Immunization >5 yrs	38	24	62	
	Total	**109**	**67**	**176**	
Socioeconomic Status	Poor	52	32	84	0.9969
	Middle Class	37	23	60	
	Rich	20	12	32	
	Total	**109**	**67**	**176**	
Educational Status	Illiterate	51	32	83	0.9835
	Secondary	39	24	63	
	Graduate	19	11	30	
	Total	**109**	**67**	**176**	
Residential Status	Urban	71	43	114	0.8971
	Rural	38	24	62	
	Total	**109**	**67**	**176**	

tetanus, however, it was up to 60 % in severe adult tetanus.[11] In a study conducted in Brazil[19] from 1981 to 2001 the study population with tetanus was divided into two groups; one before 1993 and the other after 1993 to 2001 and the mortality rate was 36 % in the group before 1993 and mortality rate was 18% in the group from 1993 till 2001. This dramatic improvement was attributed to better ICU care in Brazil. This is something the Pakistani population of this disease can benefit from by upgrading our ICU services. A study done in Lagos Nigeria by Ojini FI et al[20] reported the mortality rate was 36.96% in 349 tetanus patients. In another study done by Khan MAS et al[14,21] mortality rate was found to be 34.4% with advanced age and early onset of disease symptoms correlated as the most important determinants of in-hospital mortality. In another retrospective study done by Feroz A et al[21] overall mortality rate was found to be 22.5% with advancing age, early onset of disease symptoms, farmer profession, and rural residence status was mostly affected. In another study done at the Ivory Coast by Tanon et al,[22] it was again found that low-income people, predominantly males and of advancing ages were at high risk of mortality with an overall mortality rate of 30%. In a

study done in India by Marulappa et al[23] mortality rate was 42.2% and old age and complications were significantly correlated with higher mortality and low survival outcomes. The results of the above-mentioned studies are in accordance with our study which also reported a male predominance, increasing age, and lack of immunization and education in the study subjects.

In a study done in China by Fan Z et al[24] mortality rate was only 5.9%. This sample size was low with only 17 patients which can be a reason for lower results but a significant improvement rate and only one death in the tetanus patients was attributed to very good inpatient care and ICU services. In a study in Nepal by Shah B et al[25] mortality rate was 7.5% only with the major involvement of unvaccinated and male patients. Again a lower sample size of 40 and 7 patients discharged against medical advice with loss to follow-up could have skewed the mortality rates to a bit lower levels. However, 30 patients were on tracheostomy and mechanical ventilation and their recovery rate was significantly better due to better inpatient care and ICU services. In another study in Tanzania by Chalya PL et al[26] mortality rate was 43.1% despite giving mechanical ventilation showing the importance of improving overall management facilities and other risk factors associated with tetanus mortality. All these above-mentioned studies' results were similar to our study in aspects of advancing age of patients above 40, lack of immunization history and poor socioeconomic status, and early onset of complications. However, in contrast to other studies, our study had more urban population affected than rural one (Table 02). This could be attributed to increased road traffic accidents, increased ENT infections with ear piercings, increased street quackery, and the use of unsterilized equipment.

Another reason for the higher mortality rate in our study was our selection criteria of only severe adult tetanus patients with bad prognostic factors as mentioned in study methods compared to other studies where all patients with tetanus were selected. Had those studies only included tetanus patients like our inclusion criteria the mortality rates might have been higher. However, this can not justify our lack of infrastructure to fight this disease in its complications with better ICU and inpatient care. The high mortality rate in our hospitals is an alarming situation and a big challenge to overcome by improving our ICU facilities and increasing our field force and making such facilities easily accessible at not just in tertiary care but also at least in secondary care hospitals and we believe channeling these facilities to district levels will help reduce the mortality rate of tetanus in our environment. Good immunization programs, early interventions with anti-toxins, good ventilation support, proper wound management, continuous renal replacement therapies, better-trained nursing and ICU staff, and freely available ventilator support can reduce the case fatality rates in our setup. As a resident of the developing world with limited funding for healthcare, it seems difficult but proper utilization of resources can be helpful.

Further study is needed to find the increased urban prevalence of tetanus in Peshawar. Another issue we faced during the study was the lack of immunization records with the patient and recall bias. This issue of recall bias has been noted by Lau et al[27] and Tosun et al[28] in their studies. Many patients were not aware of post-exposure prophylaxis and they could not recall whether they had vaccination done for tetanus or not which is attributed to a lack of knowledge and awareness of our community.

Recommendations

Considering our study findings we recommend

1. Adult tetanus patients of higher age should be given appropriate care during treatment.
2. A booster dose vaccination program should be initiated for all the adult population, initiating from the high-risk groups after their identification would be preferred.
3. Patients with shorter onset of duration and lack of immunization history or post-exposure prophylaxis should be treated meticulously and preferably in a health facility with ICU care.
4. Further multicenter country-wide studies should be conducted to identify more risk factors and more stratification of different parameters and association with Comorbidities.
5. A country-wide campaign and awareness program should be initiated with the help of print and electronic media for all at-risk populations with occupation hazards like farmers etc.
6. Healthcare authorities should deploy a mechanism of keeping vaccination

records against national identification numbers of citizens which could help healthcare providers access the immunization history and many other useful history information from the past which can help in better management of the patient and avoid recall bias.

7. Tetanus immunoglobulins should be made available at healthcare facilities and a minimum dose of 500IU of tetanus immunoglobulins were as effective as conventional doses of 2500-3000 IU.

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REFERENCES

1. Sako FB, Sylla AO, Diallo MOS, Touré A, Traoré FA, Tounkara TM, et al. Tetanus: epidemiology and Factors Associated with Death in the Departement of Tropical and infectious diseases of Donka National Hospital, Guinea. Med Sante Trop. 2019 Aug 1;29(3):33-36. http://dx.doi.org/10.1684/mst.2019.0924
2. Andreadou E, Kattoulas E, Sfagos C, Vassilopoulos D. Stiff person syndrome: avoiding misdiagnosis. Neurol Sci. 2007 Mar;28(1):357-65. http://dx.doi.org/10.1007/s10072-007-0745-9
3. Megighian A, Pirazzini M, Fabris F, Rossetto O, Montecucco C. Tetanus and tetanus neurotoxin: From peripheral uptake to central nervous tissue targets. J Neurochem.2021 Sep;158(6):1244-53. http://dx.doi.org/10.1111/jnc.15330
4. Sun C, Zhao H, Lu Y, Wang Z, Xue W, Lu S, et al. Prognostic factors for generalized tetanus in adults: A retrospective study in a Chinese hospital. Am J Emerg Med. 2019 Feb;37(2):25-49. http://dx.doi.org/10.1016/j.ajem. 2018.05.039
5. Weinberger B. Adult vaccination against tetanus and diphtheria: the European perspective. Clin Exp Immunol. 2017 Jan;187(1):93-9. http://dx.doi.org/10.1111/cei.12822
6. Thwaites CL, Beeching NJ, Newton CR. Maternal and neonatal tetanus. Lancet. 2015 Jan 24;385(9965):362-70. http://dx.doi.org/10.1016/S0140-6736(14)60236-1
7. Sikendar RI, us Samad B, Ali S, Memon MI. Post traumatic tetanus and role of magnesium sulphate. J Ayub Med Coll Abbottabad. 2009 Apr-Jun;21(2): 13-25. https://www.ncbi.nlm.nih.gov/pubmed/20524490
8. Fields B, Guerin CS, Justice SB. Don't Be a Stiff: A Review Article on the Management of Tetanus. Adv Emerg Nurs J. 2021;43(1):1020. http://dx.doi.org/10.1097/TME.0000000000000333
9. Lu P, Ghiasi S, Hagenah J, Hai HB, Van Hao N, Khanh PNQ, et al. Classification of Tetanus Severity in Intensive-Care Settings for Low-Income Countries Using Wearable Sensing. Sensors. 2022 Aug 30;22(17). http://dx.doi.org/10.3390/s22176554
10. Megighian A, Pirazzini M, Fabris F, Rossetto O, Montecucco C. Tetanus and tetanus neurotoxin: From peripheral uptake to central nervous tissue targets. J Neurochem. 2021 Sep;158(6):1244-53. http://dx.doi.org/10.1111/jnc.15330
11. Sako FB, Sylla AO, Diallo MOS, Touré A, Traoré FA, Tounkara TM, et al. Tetanus: epidemiology and Factors Associated with Death in the Departement of Tropical and infectious diseases of Donka National Hospital, Guinea. Med Sante Trop. 2019 Aug 1;29(3):33-36. http://dx.doi.org/10.1684/mst.2019.0924
12. Lambo JA, Anokye EA. Prognostic factors for mortality in neonatal tetanus: a systematic review and meta-analysis. Int J Infect Dis. 2013 Dec; 17(12):e110010. http://dx.doi.org/10.1016/j.ijid.2013.05.016
13. Woldeamanuel YW, Andemeskel AT, Kyei K, Woldeamanuel MW, Woldeamanuel W. Case fatality of adult tetanus in Africa: Systematic review and meta-analysis. J Neurol Sci [Internet]. 2016 Sep 15;368:292-9. http://dx.doi.org/10.1016/j.jns.2016.07.025
14. Khan MAS, Hasan MJ, Rashid MU, Kha Sagar S, Khan S, Zaman S, et al. Factors associated with in-hospital mortality of adult tetanus patients-a multicenter study from Bangladesh. PLoS Negl Trop Dis. 2022;16(3):e0010235. https://doi.org/10.1371/journal.pntd.0010235.
15. Tetanus vaccines: WHO position paper February 2017. Wkly Epidemiol Rec. 2017 Feb 10;92(6):53-76. https://www.ncbi.nlm.nih.gov/pubmed/28185446
16. Tanriover MD, Soyler C,Ascioglu S, Cankurtaran M, Unal S. Low seroprevalance of diphtheria, tetanus and pertussis in ambulatory adult patients: the need for lifelong vaccination. Eur J Intern Med. 2014 Jul;25(6):528-32. https://doi.org/10.1016/j.ejim.2014.04.010
17. Kendall A, Anagrius K, GånheimA, Rosanowski SM, Bergström K. Duration of tetanus immunoglobulin G titres following basic immunisation of horses. Equine Vet J. 2016 Nov;48(6):7103. http://dx.doi.org/10.1111/evj.12502
18. ¨Oncu¨ SS, O¨nde M, O¨ncu¨ SS, Ergin F, O¨ztu¨rk B. Tetanus seroepidemiology and factors influencing immunity status among farmers of advanced age. Health Policy (New York). 2011; 100(23):30-59. https://doi.org/10.1016/j.healthpol.2010.11.013
19. Brauner JS, Vieira SR, Bleck TP. Changes in severe accidental tetanus mortality in the ICU during two decades in Brazil. Intensive Care Med. 2002 Jul;28(7):930-5. https://doi.org/10.1007/s00134-002-1332-4.
20. Ojini FI, Danesi MA. Mortality of tetanus at the Lagos University Teaching Hospital, Nigeria. Trop Doct. 2005 Jul;35(3):178-81. https://doi.org/13.1258/0049475054620806.
21. FerozA, Rahman M.A Ten-year Retrospective Study of Tetanus at a Teaching Hospital in Bangladesh. J Bangladesh Coll Physicians Surg. 2007;25(2). https://doi.org/10.3329/jbcps.v25i2.371

22. Tanon AK, Doumbia A, Coffie PA. Current Prognostic Factors of Tetanus in Abidjan: 20052014. J Microbiol Infect Dis. 2017; 7(June):125-31. https://doi.org/10.5799/jmid.367529
23. Marulappa VG, Manjunath R, Mahesh N, Maligegowda L. A ten year retrospective study on adult Tetanus at the epidemic disease (ED) hospital, Mysore in Southern India: A review of 512 cases. J Clin Diagnostic Res.2012;6(8):1377-80. https://doi.org/10.7860/JCDR/2012/4137.2363
24. Fan Z, Zhao Y, Wang S, Zhang F, Zhuang C. Clinical features and outcomes of tetanus: A retrospective study. Infect Drug Resist. 2019;12:1289-93. https://doi.org/10.2147/IDR.S204650
25. Shah B, Subedi M, Bartaula B, Ghimire A. Retrospective chart-review of Tetanus cases admitted in a tertiary care hospital. J Adv Intern Med. 2020;9(2):69-72. https://doi.org/10.3126/jaim.v9i2.32818
26. Chalya PL, Mabula JB, Dass RM, Mbelenge N, Mshana SE, Gilyoma JM. Ten-year experiences with Tetanus at a Tertiary hospital in Northwestern Tanzania: A retrospective review of 102 cases. World J Emerg Surg. 2011;6(1):29-34. https://doi.org/10.1186/1749-7922-6-20
27. Lau LG, Kong KO, Chew PH. A ten-year retrospective study of tetanus at a general hospital in Malaysia. Singapore Med J [Internet]. 2001 Aug;42(8):346-50. https://www.ncbi.nlm.nih.gov/pubmed/11764050
28. Tosun S, Batirel A, Oluk AI, Aksoy F, Puca E, Be´ne´zit F, et al. Tetanus in adults: results of the multicenter ID-IRI study. Eur J Clin Microbiol Infect Dis. 2017;36(8):1455-62. https://doi.org/10.1007/s10096-017-2954-3

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AUTHOR'S CONTRIBUTION
The following authors full fill authorship criteria as per ICMJE guidelines;

Khan SU, Farooq MK:	Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.
Ahmad E, Khan SS:	Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.
Qasim M, Hameed N:	Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.
Alam I:	Analysis and interpretation of data, critical revision,final approval, agreed to be accountable for all the work.