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# A Four Years Record Review of Tetanus Cases Admitted to Jimma University Specialized Hospital (JUSH), Southwest Ethiopia: A Slip of Tetanus Case Management?

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## Abstract

**Background:** Establishment of Intensive care unit (ICU) at JUSH did not improve mortality of tetanus cases due to infrequent tracheostomy and mechanical ventilation.

**Objective:** To assess the morbidity, management and mortality of tetanus cases admitted to JUSH between Jan. 2008 and Dec. 2011.

**Methods:** Retrospective review of tetanus cases was conducted from Jan. to June 2012. A total of 45 patients were reviewed. Data collection format was used for each individual case to collect information that was recorded about each patient. Data was collected by senior medical students (year V) for 15 days. Training was given for 1 day for data collectors on data collection. Data was summarized and summary statistics were calculated using scientific calculator.

**Result:** A total of 45 cases were obtained. Males accounted for 34(75.6%), 2(4.4%) were neonates and 22(48.9%) of all cases were aged between 11 and 30 years of age. None of the cases had prior immunization history for tetanus and 37(82.2%) had accessible wound. For all cases there was no evidence as to whether they sought health care for primal wound. The overall mortality was 18(40.0%). The Commonest portal of entry was traumatic wound 24(53.5%). The commonest site was lower limb, accounting for 26(57.8%). Twenty four (53.5%) had period of onset of less than 24 hours prior to admission. Twenty seven (60.0%) had incubation period of $\leq$ 14 days. At admission, generalized spasm was found in 36(80.0%) of patients and it accounted for 17(94.4%) of all deaths. Eleven (61.1%) of all deaths occurred within the first three days of admission. Quality of care at ICU was unsatisfactory and management of fever and wound were neglected.

**Conclusion:** Delayed health care seeking by patients was sacrosanct for management of tetanus. Quality of care at ICU was suboptimal. Management of fever and wound got less attention.

**Recommendations:** Prevention of tetanus through immunization, improvement of early health care seeking, organization of service at ICU, and integration of fever and wound management in tetanus case management are recommended.

**Keyword:** Jimma tetanus case management; Tetanus; Wound; Mortality

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## Introduction

The mortality caused by tetanus in various parts of the world is different. It is estimated that 578,000 infant deaths occurred due to tetanus and 140,000 deaths of young children and adults die annually due to tetanus and most deaths occurred in tropical countries [1-4].

A study conducted in Nigeria on tetanus cases which occurred during (1996-2005) showed mortality rate of 42.9% and major causes of death were aspiration pneumonia, laryngeal spasm and respiratory failure [5]. Research done in Tanzania showed mortality rate of 43.1% [6].

Study conducted in Addis Ababa, Ethiopia, on cases of tetanus admitted to Ethio-Swedish Children's Hospital during (1989-1998) revealed neonatal mortality rate of 46(74.2%) [7]. Another study in of Gondar, Ethiopia, on cases of tetanus admitted during (2000-2008) showed overall mortality of 41.4% [8].

A different study showed that treatment of tetanus cases under ICU decreased mortality to 10.0% [9].

Retrospective study of 171 tetanus cases admitted to JUSH during (1996-2009) was conducted. The cases were aged 13 and above years of age and 92.0% of all cases were aged 50 years or below. The mean age was 33 years and 75.0% of cases were males. None of the cases has prior tetanus immunization history. The case fatality rate was 38.0% and no age or sex difference was observed with regard to mortality. Tracheostomy and/or mechanical ventilation was done for 10.5% and 11.0% of cases respectively. The mean and Standard deviation (SD) of hospital stay in days for patients discharged cured and deceased were 21.5 $\pm$12 and 6.5 $\pm$6.7 respectively.

According to this study, establishment of ICU did not improve mortality due to the fact that tracheostomy and mechanical ventilation were done infrequently; appropriate tracheostomy and mechanical ventilation were recommended [10].

## Materials and Methods

Retrospective study of tetanus cases admitted to JUSH during Jan 2008-Dec 2011 was conducted from May 20-June 5/2012.

The source population was all cases admitted to JUSH between Jan. 2008 and Dec. 2011. Review of available clinical charts of cases whose primary diagnosis was tetanus was carried out. For this purpose, all clinical records of cases admitted to JUSH during the aforementioned period had to be checked, and 45 cases of tetanus were obtained. Individual data collection format, which contained space on which each patient's information was copied, was prepared.

The variables included were age sex, mode/portal of entry, site, period of onset, incubation period, admission site, clinical manifestation at admission, clinical form of the disease, severity, prior tetanus immunization, treatments given, procedures, supportive care given, outcome and hospital stay. Training was given to 3 senior medical students on data collection for one day prior to data collection. The data was categorized and summary statistics was calculator using scientific calculator.

Ethical clearance was obtained from Ethical Committee of College of Public Health and Medical Sciences of Jimma University and letter of permission was submitted to JUSH administration prior to the initiation of data collection.

## Definitions of Terms

**Source/mode:** Injury/trauma/wound and/or procedure that led to the formation of route of entry on which tetanus spore subsequently gained favorable condition for conversion to vegetative forms, as observed and/or recorded on the clinical chart by examining health person.

**Site**: The actual location of site/mode on the body, as observed and/or recorded on the clinical chart by examining health person.

**Period of onset**: The time interval between the recognition of disease by the patient/care seeker, and its recording on clinical chart, as recalled and/or told, received and/or recorded by examining health person.

**Incubation period**: Time interval between recognition of source/mode on site and the onset of clinical manifestation, as determined and/or recorded by examining health person.

**Gigger extraction**: Removal of tunga penetrans.

**Dysphagia**: Inability to swallow.

**Rhesus sardonicus**: Clinical feature of tetanus characterized by clenched teeth, lockjaw, drawing back of corners mouth, slightly protruded lips and wrinkled forehead of with look of terror.

**Trismus**: Lockjaw due to rigidity of muscles of mastication, preventing opening of mouth.

## Results

A total of 45 cases all of whom had no prior history of immunization were included in the study. The frequency of cases and deaths by year of admission is shown in **Table 1**.

The median age was 22.4 years; the minimum age was 21 days and maximum 66.0 years. Thirty (66.7%) of them were aged between 11 and 40years, as shown in **Table 2**.

Males accounted for 34(75.6%) of cases. Distribution by sex is shown in **Table 3**.

Traumatic wounds were the commonest portal of entry accounting for 24(53.3%). The frequency of portal of entry is shown in **Table 4**.

Lower limbs were the commonest site accounting for 26(57.8%). Cases whose site was not recognized had the maximum within-site mortality, as shown in **Table 5**.

Twenty-four cases (53.3%) of cases had period of onset within 24 hours and 14(77.8%) of all deaths had this period of onset, as shown in **Table 6**.

Twenty seven (60.0%) of cases were within the incubation period of $\leq$ 14 days. The mortality of cases who were in incubation period of <7 days was the highest of all, as shown in **Table 7**.

On admission 40(88.9%) of cases had trismus, followed by

**Table 1** Showing survival and deaths of tetanus cases by year of admission to JUSH, 2008-2011.

| Year | No. (%) of all cases | Survived | Deaths | Survived | Deaths |
|---|---|---|---|---|---|
| | | No. (%) of all survived | No. (%) of all deaths | No. (%) of cases within year | No. (%) of cases within year |
| 2008 | 10(22.2) | 6(22.2) | 4(22.2) | 6(60.0) | 4(40.0) |
| 2009 | 9(20.0) | 6(22.2) | 3(16.7) | 6(66.7) | 3(33.3) |
| 2010 | 14(31.1) | 8(29.6) | 6(33.3) | 8(57.1) | 6(42.9) |
| 2011 | 12(26.7) | 7(25.9) | 5(27.8) | 7(58.3) | 5(41.7) |
| **Total** | **45(100)** | **27(100)** | **18(100)** | **27(60.0))** | **18(40.0)** |

**Table 2** Showing tetanus cases and deaths by age, JUSH, 2008-2011.

| Age | No. (%) of all cases | Survived | Deaths | Survived | Deaths |
|---|---|---|---|---|---|
| | | No. (%) of all survived | No. (%) of all deaths | No. (%) of all cases within age | No. (%) of all cases within age |
| <10 years | 9(20.0) | 8(29.7) | 1(5.6) | 8(88.9) | 1(10.1) |
| 11-20 years | 12(26.7) | 10(37.0) | 2(11.1) | 10(83.3) | 2(16.7) |
| 21-30 years | 10(22.2) | 4(14.8) | 6(33.3) | 4(40.0) | 6(60.0) |
| 31-40 years | 8(17.8) | 3(11.1) | 5(27.8) | 3(37.5) | 5(62.5) |
| > 40 years | 6(13.3) | 2(7.4) | 4(22.2) | 2(33.3) | 4(66.7) |
| **Total** | **45(100.0)** | **27(100)** | **18(100)** | **27(60.0)** | **18(40.0)** |

**Table 3** Showing cases and deaths of tetanus cases by sex, JUSH, 2008-2011.

| Sex | No. (%) of all cases | Survived | Deaths | Survived | Deaths |
|---|---|---|---|---|---|
| | | No. (%) of all cases | No. (%) of all deaths | No. (%) of all cases within sex | No. (%) of all cases within sex |
| Male | 34(75.6) | 21(77.8) | 13(72.2) | 21(61.8) | 13(38.1) |
| Female | 11(24.4) | 6(22.2) | 5(27.8) | 6(54.5) | 5(45.5) |
| **Total** | **45(100)** | **27(100.0)** | **18(100.0)** | **27(60.0)** | **18(40.0)** |

**Table 4** Showing cases and deaths of tetanus cases by portal of entry, JUSH, 2008-2011.

| Portal of entry | No. (%) of all cases | Survived | Deaths | Survived No. (%) of all cases within portal of entry | Deaths No. (%) of all cases within portal of entry |
|---|---|---|---|---|---|
| | | No. (%) of all survived | No. (%) of all deaths | | |
| Traumatic wound | 24(53.3) | 15(55.6) | 9(50.0) | 15(62.5) | 9(37.5) |
| Ginger extraction | 9(20.0) | 6(22.2) | 3(16.7) | 6(66.7) | 3(33.3) |
| Chronic wound | 3(6.7) | 3(11.1) | 0(0) | 3(100.0) | 0(0) |
| Umbilical cord stamp infection | 2(4.4) | 2(7.4) | 0(0) | 2(100.0) | 0(0) |
| Not recorded | 7(15.6) | 1(3.7) | 6(33.3) | 1(14.3) | 6(85.7) |
| **Total** | **45(100.0)** | **27(100.0)** | **18(100.0)** | **27(60.0)** | **18(40.0)** |

**Table 5** Showing cases and deaths of tetanus cases by site of entry, JUSH, 2008-2011.

| Site | No. (%) of all cases | Survived | Deaths | Survived | Deaths |
|---|---|---|---|---|---|
| | | (No. (%) of all survived) | No. (%) of all deaths | (No. (%) of all survived within site) | (No. (%) of all deaths within site) |
| Not recorded | 6(13.3) | 0(0) | 6(33.3) | 0(0) | 6(100) |
| Head and neck | 6(13.3) | 2(7.4) | 4(22.2) | 2(33.3) | 4(66.7) |
| Upper limb | 2(4.4) | 1(3.7) | 1(5.6) | 1(50.0) | 1(50.0) |
| Trunk | 3(6.7) | 2(7.4) | 1(5.6) | 2(66.7) | 1(33.3) |
| Lower limb | 26(57.8) | 20(74.1) | 6(33.3) | 20(76.9) | 6(23.1) |
| UMBILICUS | 2(4.4) | 2(7.4) | 0(0) | 2(100.0) | 0(0) |
| **Total** | **45(100.0)** | **27(100)** | **18(100.0)** | **27(60.0)** | **18(40.0)** |

generalized spasm 36(80.0%). The clinical manifestations, clinical form and severity are shown in **Table 8**.

About 24(53.3%) of all patients were admitted to ICU. Two patients were given metronidazole only and TAT was given to 40 patients, as shown in **Table 9**.

Thirty seven cases had accessible wound (and there was no evidence whether care was sought for the primary wound- prior to admission) and wound debridement was done for 11 of them. On admission 10 cases had fever and there was no record of its management. Generalized spasm, wound debridement and fever are shown in **Table 10**.

**Table 6** Showing cases and deaths of tetanus cases by period of onset, JUSH, 2008-2011.

| No. (%) of all cases | Survived | Deaths | Survived | Deaths |
|---|---|---|---|---|
| | No. (%) of all survived | No. (%) of all deaths | No. (%) of all survived within period of onset | No. (%) of all deaths within period of onset |
| 24(53.3) | 10(37.0) | 14(77.8) | 10(41.7) | 14(58.3) |
| 10(22.2) | 8(29.6) | 2(11.1) | 8(80.0) | 2(20.0) |
| 6(13.3) | 5(18.5) | 1(5.6) | 5(83.3) | 1(16.7) |
| 5(11.1) | 4(14.8) | 1(5.6) | 4(80.0) | 1(20.0) |
| **45(100.0)** | **27(100.0)** | **18(100)** | **27(60.0)** | **18(40.0)** |

**Table 7** Showing cases and deaths of tetanus cases by incubation period, JUSH, 2008-2011.

| Incubation period | No. (%) of all cases | Survived | Deaths | Survived | Deaths |
|---|---|---|---|---|---|
| | | No. (%) of all survived | No. (%) of all deaths | No. (%) of all survived within period of incubation period | No. (%) of all deaths within period of incubation period |
| < 7 days | 11(24.4) | 3(11.1) | 8(44.4) | 3(27.2) | 8(72.8) |
| 7-14 days | 16(35.6) | 12(44.4) | 4(22.2) | 12(75.0) | 4(25.0) |
| > 14 days | 8(17.8) | 6(22.2) | 2(11.1) | 6(75.0) | 2(25.0) |
| Not recorded | 10(22.2) | 6(22.2) | 4(22.2) | 6(60.0) | 4(40.0) |
| **Total** | **45(100.0)** | **27(100.0)** | **18(100)** | **2760.0)** | **18(40.0)** |

**Table 8** Showing tetanus cases by common clinical manifestation, clinical form and severity, JUSH, 2008-2011.

| Clinical Manifestation at admission | Yes No. (%) |
|---|---|
| Trismus | 40(88.9) |
| Generalized spasm | 36(80.0) |
| Fever | 10(22.2) |
| Dysphagia | 4(8.9) |
| Rhesus sardonicus | 3(6.7) |
| Neck stiffness | 2(4.4) |
| Clinical Form | No. (%) |
| Generalized tetanus | 29(64.4) |
| Cephalic | 1(2.2) |
| Local | 0(0) |
| Neonatal tetanus | 2(4.4) |
| Not recorded | 13(28.9) |
| Total | 45(100.0) |
| Severity | No. (%) |
| Mild | 6(13.3) |
| Moderate | 5(11.1) |
| Severe | 25(55.6) |
| Not recorded | 9(20.0) |
| **Total** | **45(100.0)** |

ICU contributed to 17(94.4%) of all deaths and 20(95.2%) of all those admitted to either tetanus room or unidentified place survived. Eleven (61.1%) of all deaths occurred in the first three days of hospitalization. A closer look at ICU charts revealed that:

Tracheostomy was done for 11(45.8%) of 24 cases and that 7(63.6%) of the 11 tracheostomies were done after 12 hours of admission to ICU.

The reason for failure to do tracheostomy for 13 cases was not documented except for 1 pediatric case and it was lack of appropriate tube.

**Table 9** Showing tetanus cases by admission site and medications, JUSH, 2008-2011.

| Admission | Adult | Pediatric | Total |
|---|---|---|---|
| | No.(%) | No. (%) | No. (%) |
| ICU | 20(44.4) | 4(8.9) | 24(53.3) |
| Tetanus room | 4(8.9) | 6(13.3) | 10(22.2) |
| Not recorded | 11(24.4) | 0(0) | 11(24.4) |
| **Total** | **35(77.8)** | **10(22.2)** | **45(100.0)** |
| Medication | Adult (No.) | Pediatric(No.) | Total(No.) |
| Crystalline penicillin | 33 | 10 | 43 |
| Metronidazole only | 2 | 0 | 2 |
| Diazepam | 35 | 10 | 45 |
| CPZ | 35 | 10 | 45 |
| TAT | 30 | 10 | 40 |

Mechanical ventilation was done for 15(62.5%), and oxygen for 15(62.5%). However there is no record of the pattern.

Suctioning was done for 11(45.8%) but there is no record of the pattern (**Table 11**).

NGT (Nasogastric tube) for feeding was inserted for 15(62.5%) and there was no record of whether NGT was inserted or not for 9(37.5%) of cases.

There was no written evidence for all 24 cases as to whether catheterization and bowel care was done and given.

Nine (50.0%) of deaths was due to laryngeal spasm. The cause of death for 4(22.2%) was not recorded. The causes of deaths are shown in **Table 12**.

## Discussion

The overall mortality in this study was 40.0% which was similar to the study conducted previously at JUSH which was 38.0% **[10].** There are, however, inherent differences between these two studies like sample size. Mortality within age groups peaks

**Table 10.1** Showing tetanus cases and deaths by generalized spasm wound care and fever, JUSH, 2008-2011.

| Generalized spasm | Died | Survived | |
|---|---|---|---|
| Yes | 17 | 19 | 36 |
| No | 1 | 8 | 9 |
| **Total** | **18** | **27** | **45** |
| **Wound debridement** | **Died (No.)** | **Survived (NO.)** | **Total (No.)** |
| No | 14 | 12 | 26 |
| Yes | 2 | 9 | 11 |
| **Total** | **16** | **21** | **37** |
| Fever >37.80 C | Died | Survived | - |
| Present | 8 | 2 | 10 |
| Absent | 10 | 25 | 35 |
| **Total** | **18** | **27** | **45** |

at age 21-30 and stabilizes thereafter while respective overall proportions of survivals and deaths both showed decreasing tendency after age of 20 years.

Modes/portal of entry can be viewed as different labels for the same underlying phenomena.

Site has prognostic importance in this study, unlike previous study at JUSH [**10**]. The within site risk of mortality tended to rise as location moves up towards head and neck. Sites located on lower limbs were commonest and mildest while those on head and neck were less common and severe. The importance of site is also reflected in the fact that cases with unrecorded sites had 100% mortality.

In this study, Period of onset had prognostic importance, like the previous study done in this same hospital [10]. Mortality within groups of period of onset tended to rise as period of onset becomes shorter. However period of onset can possibly be determined by site. In other words, what makes period of onset shorter or longer can be the site and that it (period of onset) may not depend on time but on the site/order of presentation. Furthermore, it seems a paradox in that patients with shorter period of onset (arrived relatively earlier) had higher mortality. This is simply due to the fact that the worker (the disease) had been more powerful than the worker (the patient).

Mortality within incubation periods tended to rise with shorter incubation period. However incubation period can be highly dependent on the site and the nature of the wound on site.

Generally higher mortality was observed among patients with sites on upper part of body, shorter incubation period, shorter period of onset.

The fact that 36(80.0%) of cases had generalized spasm on admission and that 17(47.2%) of those with generalized spasm died while 1(11.1%) of those with no generalized spasm died shows need for understanding of the course of the disease, for localized and cephalic forms can also progress to generalized form.

Patients admitted to ICU contributed to 17(94.4%) of all deaths and 11(61.1%) of all deaths occurred within the first three days of hospitalization. Both the patient's condition at admission and the quality of service after admission determine patient's fate.

Wound debridement improved survival, but there is conflicting issue in that the number of cases whose site was not recorded was 6 of which 6 died but the total number of cases who deserve wound care was 37 of which 16 died. It is possible that the wound could be post admission phenomena or error in recording.

There was some indication that presence of fever was related with high probability of death. This may be due to systemic infection, or some locus of infection which if not identified might have led to complications and subsequent death.

The cause of death was mentioned for 12(66.7%) of all deaths. However, there was no record of how and why of the deaths. There were also 4 cases whose cause of death was not recorded.

When we compare the results of this study with previous studies in this same hospital, in both studies all patients had no immunization history. Regarding the procedures, previous study at JUSH showed that tracheostomy and mechanical ventilation was done for 10.5% and 11.0% of cases respectively. In this study tracheostomy was done for 45.8% and mechanical ventilation for 62.5%. The mean and standard deviation (SD) of hospital stay-in-days for patients discharged cured and deceased were 21.5 $\pm$ 12 and 6.5 $\pm$ 6.7 respectively in previous study. The mean (and range) duration of hospital stay for discharged cured was 18(4-51) and that for deaths was 3.2(1-8) days in this study. Mortality was 38.0% in previous study and 40.0% in the current study [10].

## Conclusions

Delayed health care seeking by patients had determinant role for management outcome.

Management of fever and wound got less attention.

Quality of care at ICU was suboptimal.

Prevention of tetanus could have minimized the mortality.

## Recommendations

Prevention of tetanus through immunization is irreplaceable option.

Improved health seeking must be encouraged.

Management of fever and wound must be integral to tetanus case management.

Service at ICU needs to be directively organized.

## Strengths and weakness of the study

Small number of cases and missing data has made further statistical analysis difficult. Even then the results give insight to clinically significant outcomes.

## Acknowledgement

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**Table 10.2** Showing tetanus cases and deaths within admission site, JUSH, 2008-2011.

| Admission | No. (%) of all cases | Survived | Deaths | Survived | Deaths |
|---|---|---|---|---|---|
| | | No. (%) of all survived | No. (%) of all deaths | No. (%) of all survived within admission | No. (%) of all deaths within admission |
| ICU | 24(53.3) | 7(25.9) | 17(94.4) | 7(29.2) | 17(70.8) |
| Other | 21(46.7) | 20(74.1) | 1(5.6) | 20(95.2) | 1(4.8) |
| **Total** | **45(100.0)** | **27(100)** | **18(100.0)** | **27(60.0)** | **18(40.0)** |
| Hospital stay | 12.1 (1-51) | 18(4-51) | 3.2(1-8) | - | - |

**Table 11** Showing tetanus cases by procedures, JUSH, 2008-2011.

| Procedure | Done | Not done/not recorded | Total |
|---|---|---|---|
| | No. (%) | No. (%) | No. (%) |
| Tracheostomy | 11(45.8) | 13(54.2) | 24(100.0) |
| Suctioning | 11(45.8) | 13(54.2) | 24(100.0) |
| Mechanical ventilation | 15(62.5) | 9(37.5) | 24(100.0) |
| Oxygen | 15(62.5) | 9(37.5) | 24(100.0) |
| NGT | 15(62.5) | 9(37.5) | 24(100.0) |

**Table 12** Showing tetanus cases by cause of death, JUSH, 2008-2011.

| Cause of Death | No. (%) |
|---|---|
| Laryngeal spasm | 9(50.0%) |
| Aspiration pneumonia | 3(16.7) |
| Sepsis with multiorgan failure | 1(5.6) |
| Uremia | 1(5.6) |
| Not recorded | 4(22.2) |

## References

1 Parry EHO (1984) Principles of Medicine in Africa. Oxford University Press. pp: 297-306.

2 Harrison Principles of Internal Medicine (2009). pp: 898-900.

3 Stephen SA Nelson's Textbook of Pediatrics (2007). pp: 951-953.

4 Berdenhelel E (1998) Tetanus Surveillance in United States. P: 41.

5 Onwuchekwa Arthur Chukwubike, Asekomeh Eshiofe God's powers (2009) A 10 Year Review of Tetanus in Adults at a Nigerian Tertiary Hospital.

6 Phillipo L Chayla, Joseph M, Ramesh M. Ten-Year's Experience with Tetanus at a Tertiary Hospital in Northern Tanzania: A Retrospective Analysis of 102 Cases

7 Amsalu S, Lulseged S (2005) Tetanus in a Children's Hospital in Addis Ababa: Review of 113 Cases Ethiop. Med. J. Oct. 43: 233-240.

8 Taddese A, Gebresellsie S (2009) Cases Review at Gondar University Hospital. Ethiop. Med. J. 47: 291-297.

9 Abrutyn E, Berhi JA (1995) Intrathecal Therapy in Tetanus. Meta Analysis. JAMA. 266: 262-267.

10 Amare Al, Yami Al (2011) A case Fatality of Adult Tetanus at Jimma University Teaching Hospital, Southwest Ethiopia, African Health Sciences. 11: 36-40.