

Tetanus: A Retrospective Study of Clinical Presentations and Outcomes in a Medical Teaching Hospital

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Background: Tetanus has been a serious infectious disease with high mortality and morbidity. Some clinical factors can predict its severity.

Objective: Survey the clinical profiles, their correlation with the severity of tetanus and the final outcomes after treatment.

Material and Method: A retrospective study of the medical records of patients with tetanus who attended Songklanagarind hospital between January 1982 and June 2008 was done. The correlation between clinical profiles and severity was analyzed by Fisher exact test to detect the significant correlation ($p < 0.05$).

Results: Forty-seven cases of tetanus, composed of 36 male and 11 female patients, were reviewed. The mean age of onset was 45.5 years ($SD = 19.6$ years). Generalized tetanus was the most common form found (91.4%). History of injury or wound was reported in 80.8%. Age over sixty, puncture wound, onset time of less than seven days, and generalized tetanus, significantly correlated with clinical severity. Only two cases died, but the rest of the cases had residual muscle rigidity after treatment.

Conclusion: The overall clinical features of tetanus and their correlation with the disease severity were presented. Unlike in the past, patients with tetanus can now be reversible under appropriate intensive critical care.

Keywords: Prognosis, Tetanus, Treatment outcome

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Tetanus was first known in ancient Egypt over 3,000 years ago. Though it is now uncommon in developed countries where immunization has a wide coverage, it remains a major public health problem in under developed countries. It was estimated that 800,000-1,000,000 deaths from tetanus occurred each year⁽¹⁾, in which neonatal tetanus composed half of the number. The incidence and death rate of tetanus was much higher in African and South East Asian countries⁽²⁾. In South Africa 300 cases were estimated to occur every year⁽³⁾, while only 12-15 cases were reported each year in Britain⁽²⁾ and 50-70 cases in the USA^(4,5). Apart from neonatal tetanus, generalized

tetanus in adults also had high mortality and morbidity rate.

Tetanus is caused by *Clostridium tetani*, an obligate anaerobic and spore forming giving the drumstick appearance of gram positive bacteria. It is commonly isolated from soil, rusted metal and the intestinal lumen of many domestic animals and humans. The potent neurotoxin of tetanus, whose DNA is contained in the plasmid, produces a diversity of neurological disorders with variable degrees of severity⁽³⁾. The most common clinical presentation of tetanus is muscle rigidity and spasm. Though trismus is the universal presenting localized symptom of tetanus in most cases, dysphagia, paraspinal muscles rigidity, and localized rigidity at the site of bacterial entry have been reported. Abdominal muscle rigidity, mimicking an acute abdominal condition, sometimes

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presented⁽⁶⁾. The respiratory and autonomic nervous systems are impaired leading to high mortality in the severe cases. Since tetanus is diagnosed by clinical evidence, suspicion in cases presenting with muscle rigidity should be raised for caution of a delayed diagnosis or even misdiagnosis. Moreover, various clinical parameters have been proved to predict the severity and the outcome of tetanus.

The authors aimed to study the clinical presentations, the treatments and the final outcomes of all cases in which tetanus was the diagnosis in Songklanagarind Hospital, a tertiary and medical teaching hospital in southern Thailand.

Material and Method

Songklanagarind is a tertiary care and medical teaching center in the lower south of Thailand. They have 836 in-patient beds available with an occupancy rate of 95%. The medical records of all cases with tetanus as the final diagnosis, between January 1982 and June 2008 were included. The authors collected patients' demographic data and clinical details such as the presence or absence of preceding injury, type of wound, history of vaccination, incubation period, onset time, presenting symptoms, Albett severity grading score, total days of requiring ventilation support and admission to ICU and the final outcome after treatment. Data was shown in a descriptive form of frequency, percent, mean, and standard deviation. The correlation between both clinical parameters and demographic data and the Albett severity score were analyzed by Fisher exact test to detect the level of clinical significance ($p < 0.05$). The present study was approved by the Ethics Committee of the Faculty of Medicine, Prince of Songkla University.

Results

From the authors' review, 47 cases of tetanus were identified and included in the present study with 36 male and 11 female patients. Their mean age at the onset of symptoms was 45.5 years ($SD = 19.6$, range of 15-88 years). Twelve cases were older than 60 years. Most of the studied cases were agricultural workers and laborers. Forty-three cases were diagnosed as generalized tetanus (91.4%), while three cases were localized tetanus and only one case of cephalic tetanus was diagnosed. Unexpectedly, two cases were missed in the diagnosis of tetanus at the initial assessment. One of them who presented with severe dysphagia but minimal locked jaw and low-grade fever was diagnosed as deep cervical soft tissue infection, while the other

who presented with marked abdominal muscle rigidity was diagnosed as peptic perforation. Thirty-eight cases (80.8%) had a definite history of preceding injury that ranged from minor wound to open fracture from traffic accidents. Puncture wound was the most common type of wound recorded among the included cases (52.6%). None of the studied cases had completed their pre-exposure vaccination program and even post-exposure vaccination was totally neglected in 33 cases (70.2%). Only two cases had the highest post-exposure vaccination of two injections, while 12 cases had only one injection after injury. In none of the cases was tetanus immunoglobulin given.

The incubation period recordable from 40 cases ranged from 1-30 days (mean = 9.2 days, and $SD = 6.3$ days) and the onset time recordable from 41 cases ranged from 1-17 days (mean = 2.1 days, and $SD = 1.7$ days). Fourteen cases had incubation periods of less than seven days (34.1%) and 39 cases had onset time of less than seven days (95.1%). Trismus was the most common initial presenting symptom (87.2%), followed by generalized muscle rigidity (48.9%), and dysphagia (27.7%). Three cases were classified as grade IV of Albett severity-grading score, 12 cases were grade III, 17 cases were grade II, and 14 cases were grade I. Twenty-six cases needed respiratory support (55.3%).

The mean duration of ventilation support days needed was 10.2 days ($SD = 12.2$ days). Parenteral muscle relaxants were needed in 41 cases for controlling muscle rigidity. Only intravenous diazepam was given in 25 cases and the combination of diazepam and other muscle relaxants, commonly pancuronium, was given in 14 cases. Atracurium was given in the remaining two cases. Intravenous diazepam, as much as 240 mg/d for up to 23 days maximally, was given to reduce the muscle rigidity in six severe cases. Either penicillin or metronidazole was the antibiotic given parenterally in 32 and 11 cases respectively, without significant difference in the clinical outcome. Of all treated cases, 42 cases were discharged with axial muscle rigidity or spasm, and only one case was totally free of complications. Two cases died, one from severe hospital acquired infection and the other from secretion obstruction. One case was discharged against medical advice (Table 1).

The correlation between clinical parameters and Albett severity score was evaluated. For the patients older than 60 years, they had a significantly higher severity score than the younger ones ($p = 0.006$). Generalized tetanus and those who had had obvious wounds also showed a significantly higher severity

Table 1. Clinical characteristics of patients with tetanus

Characteristics (n = 47)	n (%)
Gender - male : female	36:11 (76.6:23.4)
Age - mean = 45.5, and SD = 19.6	
60 yrs or more	12 (25.5)
Less than 60 yrs	35 (74.5)
Forms of tetanus	
Generalized	43 (91.4)
Localized	3 (6.4)
Cephalic	1 (2.2)
Present of wound or history of injury	
Yes	38 (80.8)
No	9 (19.1)
Type of wound	
Puncture	20 (52.6)
Abrasion	5 (13.2)
Laceration	13 (34.2)
Surgical wound	-
History of vaccination	
Complete primary vaccination	-
Booster each 5-10 years	-
Post exposure vaccination	
None	33 (70.2)
1 dose	12 (25.5)
2 dose	2 (4.3)
3 dose	-
Tetanus immunoglobulin	-
Incubation period	
Less than 7 days	14 (34.1)
7 days or more	26 (65.5)
Onset time	
Less than 7 days	39 (95.1)
7 days or more	2 (4.5)
Presenting symptoms	
Trismus	41 (87.2)
Dysphagia	13 (27.7)
Opisthotonos	9 (19.1)
Reflex spasm	8 (17.0)
Localized rigidity	5 (10.6)
Generalized rigidity	23 (48.9)
Albett severity grading	
Grade I (mild)	14 (30.4)
Grade II (moderate)	17 (36.9)
Grade III (severe)	12 (26.1)
Grade IV (very severe)	3 (6.5)
Antibiotic used	
Penicillin	32 (74.4)
Metronidazole	11 (25.6)
Outcome	
Dead	2 (4.3)
Recover with rigidity/spasm	42 (91.3)
Recover with non-neurological complication	1 (2.2)
Recover without complication	1 (2.2)

score than other forms of tetanus and those who had no wounds ($p < 0.001$ both). Puncture wounds correlated with a higher severity score than other types of wounds ($p = 0.003$). In contrast to the incubation period, an onset time of less than seven days predicted the severity of the disease ($p = 0.02$).

The effects of antibiotics and muscle relaxants, used in the present study while patients were on ventilation support, were also evaluated. The mean duration of ventilation support in the group in which penicillin was given was 12.2 days ($SD = 13.4$ days) compared with 8.6 days ($SD = 9.1$ days) in the group that metronidazole was prescribed. However, there was no statistical significant difference by student t-test ($p = 0.43$). When comparing the mean duration of assisted ventilation needed between the group of intravenous diazepam alone and that of combined diazepam with pancuronium, it was found that the mean days of ventilation needed was 6.5 days ($SD = 11.7$ days) in the diazepam alone group, and 18.8 days ($SD = 10.8$ days) in the combination group with statistical significance ($p = 0.02$).

Discussion

Forty-seven cases of tetanus were identified and reviewed from the study period of 25 years. The last case was identified in the year 2004. Most of them were male, aged under sixty, and agricultural workers. Generalized tetanus was the most common form of tetanus found in the present study. History of antecedent injury and wound was noted in most of the cases (80.8%). The injuries, which commonly happened in their daily life or work, were mostly minor and sometimes ignored. Only in a few cases was an injury obvious or severe enough to need medical care. Previous studies showed that up to 25% to 30% of cases diagnosed with tetanus had no documented evidence of injury or wound preceding the diagnosis⁽⁵⁾. Tetanus had been reported in association with variable types of wounds and injuries including those caused by household materials, work-related tools and even intravenous or intramuscular drug injections, acupuncture, or surgical procedures. However, no case of tetanus following surgeries or medical procedures was found in the present series. Some chronic and non active infection sources such as otitis media and decubitus ulcer have been reported to be the portal of bacterial entry⁽⁷⁻⁹⁾. Two of the presented cases had chronic ulcers that were possible to contribute to tetanus infection; one had otitis media and the other with breast cancer had a chronic post radiation ulcer.

Puncture wound was common in the present series. Since it was a closed wound and the injury was so minor that it was ignored, which in fact promote the anaerobic conditions within the wound and the growth of the *Clostridium tetani* later. The incubation period, the time interval between bacterial inoculation and the presentation of the first symptom, had an important prognostic power in the disease. It can extend from 1-60 days with the average of 7-10 days⁽¹⁰⁾. Onset time, the duration between the presentation of the first localized symptom to generalized muscle spasm, was another significant predictor for disease severity. It usually ranges from 1-7 days⁽¹⁰⁾. The shorter the duration of the incubation period or the onset time (less than 7 days) is, the more severe the disease is. This may reflect the distance the neurotoxin has to travel to reach the central nervous system or the amount of neurotoxin produced by *Clostridium tetani* at the site of its entry. However, in the present study only the onset time had significant association with the severity of tetanus. The limitation of the present study design and the low number of cases studied may be the cause of this discrepancy. Trismus was the most common presenting symptom in our study like other previous studies. Typically, cranio-caudal progression of muscle rigidity produced generalized muscle rigidity and spasm finally. A study showed that over 80% of cases had dysphagia as its initial co-manifestation⁽¹¹⁾. Abdominal muscle rigidity is another initial clinical manifestation of tetanus that sometimes mimics acute abdominal surgical conditions. Both manifestations may mislead the physician in the diagnosis of tetanus.

Apart from the onset time, the authors also found that age over 60, generalized tetanus, and presence of wound and puncture wound had significant correlation with the clinical severity. All of these, except for puncture wounds, had been documented as clinical prognostic indicators of Dakar score, a prognostic scoring system⁽¹²⁾. The choice for either penicillin or metronidazole made no difference in duration of the clinical course and outcome. Though high doses of parenteral penicillin can lower the seizure threshold theoretically, no clinically obvious seizures were noted in the penicillin-treated group in the present study. The significantly shorter duration of ventilator days in diazepam-used alone group, in comparison with combined diazepam and pancuronium group, may reflect the less severe clinical course in the former group. The residual axial or localized muscle rigidity was commonly encountered after successful treatment of tetanus in most cases.

The status of primary and post injury prophylactic vaccination for prevention of tetanus was poor in the studied cases. The state of immunization is a prognostic factor in the Phillip severity scoring system⁽¹³⁾. The authors believe that the incidence of tetanus has been reduced after the implementation of a countrywide promotion of a primary vaccination program in pre-school children. However, an every-ten-year booster dose is necessary to maintain the protective level of immunity because it has been shown that 49-66% of people older than 60 years had inadequate protective immunity level^(4,14-17). Therefore, this recommendation should be emphasized for all adults.

The retrospective study design and small sample size were the major limitations and weakness of the present study. However, it can illustrate the whole clinical pictures of tetanus and some significant clinical data useful for clinical application. Though the incidence of tetanus has been reduced, even in some underdeveloped countries, physicians may encounter a tetanus case once in a while. Suspicion of tetanus has to set up in cases presenting with localized or generalized muscle rigidity. The disease is serious and has been associated with a high mortality and morbidity rate. However, appropriate implementation of recent and advanced intensive care facilities can yield a favorable outcome in treating cases of tetanus. Completion of immunizations, both pre-and post-exposure programs, in combination with appropriate wound care have to be emphasized in their significance for tetanus prevention to the public.

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บาดทะยัก การศึกษาย้อนหลังเกี่ยวกับอาการแสดงและผลการรักษาในโรงเรียนแพทย์แห่งหนึ่ง

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ภูมิหลัง: บาดทะยักเป็นโรคติดเชื้อรุนแรงที่มีอัตราการตายและอัตราความพิการสูง ปัจจัยทางคลินิกบางประการสามารถไขพยากรณ์ความรุนแรงของโรค

วัตถุประสงค์: การศึกษาแบบย้อนหลังนี้มีจุดมุ่งหมายที่จะสำรวจลักษณะทางคลินิก ความสัมพันธ์ของอาการเหล่านี้กับความรุนแรงของโรคและผลลัพธ์ของการรักษา

วัสดุและวิธีการ: ลักษณะทางประชากรและลักษณะทางคลินิกของผู้ป่วยบาดทะยักถูกรวบรวมตั้งแต่ เดือนมกราคม พ.ศ. 2525 ถึง มิถุนายน พ.ศ. 2551 จากแฟ้มประวัติของโรงพยาบาล และนำเสนอในรูปแบบข้อมูลเชิงพรรณนา ความสัมพันธ์ระหว่างอาการแสดงกับความรุนแรงของโรคถูกทดสอบด้วยการทดสอบแบบฟิชเชอร์ เอ็กแซต เพื่อหาความสำคัญทางสถิติ ($p < 0.05$)

ผลการศึกษา: ผู้ป่วยทั้งสิ้น 47 ราย เป็นชาย 36 ราย และหญิง 11 ราย ถูกรวบรวมเข้าในการศึกษา อายุเฉลี่ยของกลุ่มตัวอย่างคือ 45.5 ปี (SD = 19.6 ปี) บาดทะยักทั้งตัวเป็นรูปแบบที่พบได้มากที่สุด (91.4%) ประวัติบาดแผลพบได้ 80.8% พบว่า อายุที่มากกว่า 60 ปี บาดแผลถูกทิ่มตำ ระยะเวลาเริ่มต้นอาการน้อยกว่า 7 วัน และบาดทะยักทั้งตัวมีความสัมพันธ์อย่างมีนัยสำคัญกับความรุนแรงของโรค มีผู้ป่วยเพียง 2 รายที่เสียชีวิต แต่ที่เหลือมีอาการเกร็งของกล้ามเนื้ออคงค้างภายหลังการรักษา

สรุป: ลักษณะทางคลินิกโดยรวมของบาดทะยักและความสัมพันธ์กับความรุนแรงของโรคได้ถูกการนำเสนอสิ่งที่แตกต่างจากในอดีตคือ ปัจจุบันผู้ป่วยที่เป็นบาดทะยักสามารถรักษาให้ฟื้นคืนได้ภายใต้การรักษาด้วยเวชปฏิบัติวิฤฤติที่เหมาะสม