Conclusions: The survival of Tetanus patients is as high as 91.7%, if early and aggressive management was initiated in the Emergency room and continued in ICU along with prompt supportive care and counseling of the patient and family members.

Keywords: Outcome, Tetanus.

INTRODUCTION

Tetanus remains a major health problem worldwide. The worldwide incidence of tetanus approaches one million cases per year (1). Tetanus is an uncommon disease in the United States but continues to have a substantial global health impact (1, 2). The prevalence of tetanus is highest in developing countries where it is among the ten most frequent causes of death and an important cause of infant mortality (1, 3, 4, 5). Tetanus is associated with a mortality rate of 20 to 50 percent and at least half of these deaths occur in neonates (4). Immunization has dramatically reduced the incidence of tetanus in the developed countries (1, 4). It is most commonly found in the low socio economic group, improper immunization, farmers and illiterates (3, 5). Most of them are the bread winners of the family (3). Although there are a million cases reported each year globally, there are still many under reported, under diagnosed and under treated (6, 7). The severity of the disease, duration of the treatment, complications of the disease, nosocomial infections, cost of the treatment and inadequate counseling of the family remains a threat to the patient and the treating physician (3, 8). Early diagnosis, meticulous and aggressive treatment initiating from the emergency room to the critical care can result in successful outcome with complete recovery (1, 3, 8).
METHODS
It is a prospective observational study done from October 2007 to January 2010. All patients with clinical diagnosis of tetanus were included in the study. Patients discharged against medical advice were excluded from the study. All patients were managed according to Vinayaka Mission University Hospital protocol.

Management protocol:
Airway and breathing was the first priority. Elective endotracheal intubation or early tracheostomy was done at ER (9). All patients were paralyzed with Vecuronium and supported with mechanical ventilation (10, 11, 12). All patients received Midazolam & Fentanyl infusions for the first few days later converted to lorazepam and buprinorphine to control pain and spasms (1, 3, 8, 13). They were started on vaccination with tetanus toxoid (0, 1 and 2 months with advice to have booster dose every 5 years). Tetanus Immuno Globulin was administered at low doses only due to financial constraints (1, 4, 14). They were admitted in ICU with appropriate care. Metronidazole was the initiated at the dose of 500mg intravenously, 8th hourly for 21 days for all patients (15, 16). From the second week every second day, paralysis was stopped and patient was reassessed for spasm. Vecuronium was continued until spasm was relieved. Autonomic instability was managed with Magnesium sulphate and Clonidine (17, 18, 19, 20). Intravenous Magnesium sulphate was started electively at a dose of 2-4 grams stat and then 1 to 2 grams as IV infusion twice daily. Serum magnesium levels were monitored once in every three days. Serum Calcium, Urea and Creatinine were checked at regular intervals and urine output monitored closely. Nutrition requirement was calculated appropriately and supplemented with high proteins (1). Other complications during treatment were managed appropriately. All the patients were taken care of supportive measures like bed sore prevention, nosocomial infections prevention, deep venous thrombosis prophylaxis, stress ulcer prophylaxis, oral hygiene, fluids & electrolytes, physiotherapy. They were subsequently weaned from the ventilator. They were followed up until discharge.

Data collection:
Parameters like age, sex, causes, incubation period, onset time, severity on admission, progression of severity, duration of autonomic instability, complications met during treatment, duration of ventilator requirement, duration of ICU stay, duration of in hospital stay, condition at the time of discharge, expenditure for treatment and mortality were collected. Incubation period was counted from then time of injury to the onset of first symptom. Onset time was counted from the time of the first symptom to the first spasm, severity on admission was scored as per Ablett classification of severity of tetanus [Table 1], duration of ventilator requirement considered from the day of initiation of ventilation to till weaning from ventilator, condition at the time of discharge was considered as recovered completely when the patient does not have any residual problem at the time of discharge and considered as improved when the patient is weaned from ventilator but have some weakness at the time of discharge and dead when declared. Total expenditure includes drugs, investigation in our medical college set up.

Data Analysis:-
All data were compiled into Microsoft Excel 2007 spread sheet and statistical analysis was accomplished using statistical method for calculations provided within “Statistical package for social science” software [version 11.5]. The range, mean and standard deviation were calculated for the studied parameters.

RESULTS
A total of 13 patients were diagnosed as Tetanus, of which one patient was discharged against medical advice. The study sample analyzed consisted of 12 cases, of which 91.7% were male and 8.3% were female. The mean age was 51.75 years [SD = 13.975]. Of 12 patients in the study, Tetanus is most commonly caused by thorn pricks [50.0%] and trivial trauma [33.33%]. The incubation period (time between injury and first symptom) ranged from 2 to 60 days with a mean of 13.333 days [SD = 16.115]. The onset time (time between first symptom and first spasm) ranges between one day to four days with a mean of 1.583 days [SD = 0.877]. Severity of tetanus based on Ablett classification showed that most of the patients presented with grade II severity [50.0%] (21) [TABLE 1]. But it is not uncommon for presentations with grade IV severity [16.67%] which is
associated with autonomic disturbances. However, nine out of eleven patients [81.8%] who survived progressed to grade IV severity within the second week of admission, although seven out of eleven patients [63.6%] progressed to grade IV within the first week of admission. Autonomic instability was not observed in two of the studied patients [16.67%]. In patients who developed autonomic instability, the mean onset was 3.727 days [SD = 3.228]. The mean duration ranged from zero to twenty five days with a mean of 14.0 days [SD = 9.413]. On observing the duration of ventilator requirement, ICU stay and in hospital stay it was found that an average of 25.455 days [SD = 5.447] was required for mechanical ventilation with a range of 15 to 36 days, an average of 30.818 days [SD = 5.492] was required in ICU stay with a range of 22 to 40 days and an average of 33.091 days [SD = 6.074] was required for total stay in the hospital until discharge with a range of 23 to 42 days [TABLE 2].

Most of the studied patients developed more than one complication. The complications in decreasing order of frequency were sepsis [41.7%], acute respiratory distress syndrome [25.0%], nosocomial infections [25.0%], acute kidney injury [16.7%], respiratory failure [16.7%], critically ill neuropathy [16.7%], central diabetes insipidus [16.7%], ICU psychosis [16.7%], cardiac arrest [8.3%], atrial fibrillation [8.3%], limb cellulites [8.3%] and contractures [8.3%].

Among the twelve patients, nine [75.0%] were discharged with complete recovery. Two [16.7%] patients had improved and required only ambulation, frequent physiotherapy and were discharged at request. However, one [8.3%] patient was declared dead on the first day of admission pertaining to his delayed presentation. Overall, eleven out of twelve patients [91.7%] survived [GRAPH 1]. Finally, the calculated approximate expenditure of each patient ranges from Rs.93, 000 to Rs.196, 000 with a mean of Rs.1, 48,181.82 [SD = 33,965.65] [GRAPH 2].

### TABLE 1: ABLETT CLASSIFICATION OF SEVERITY OF TETANUS

<table>
<thead>
<tr>
<th>GRADE</th>
<th>CLINICAL FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Mild: mild to moderate trismus; general spasticity; no respiratory embarrassment; no spasms; little or no dysphagia.</td>
</tr>
<tr>
<td>II</td>
<td>Moderate: moderate trismus; well-marked rigidity; mild to moderate but short spasms; moderate respiratory embarrassment with an increased respiratory rate greater than 30; mild dysphagia.</td>
</tr>
<tr>
<td>III</td>
<td>Severe: severe trismus; generalized spasticity; reflex prolonged spasms; increased respiratory rate greater than 40; apnoeic spells; severe dysphagia; tachycardia greater than 120.</td>
</tr>
<tr>
<td>IV</td>
<td>Very severe: Grade III and violent autonomic disturbances involving the cardiovascular system. Severe hypertension and tachycardia alternating with relative hypotension and bradycardia, either of which may be persistent.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case</th>
<th>Age/Sex</th>
<th>Cause</th>
<th>Severity on admission</th>
<th>Incubation period [days]</th>
<th>Onset time [days]</th>
<th>Autonomic instability [days]</th>
<th>Spasms [days]</th>
<th>Assisted ventilation [days]</th>
<th>ICU stay [days]</th>
<th>In hospital stay [days]</th>
<th>Disposition</th>
<th>Approximate expenditure [Rs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>62/M</td>
<td>Thorn prick</td>
<td>II</td>
<td>7</td>
<td>1</td>
<td>16</td>
<td>23</td>
<td>29</td>
<td>32</td>
<td>34</td>
<td>Recovered</td>
<td>1,93,400</td>
</tr>
<tr>
<td>2</td>
<td>18/M</td>
<td>Thorn prick</td>
<td>IV</td>
<td>60</td>
<td>1</td>
<td>25</td>
<td>28</td>
<td>31</td>
<td>33</td>
<td>35</td>
<td>Improved</td>
<td>1,70,500</td>
</tr>
</tbody>
</table>
### TABLE 2: PATIENT CHARACTERISTICS

<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>Gender</th>
<th>Injury Type</th>
<th>Injury Location</th>
<th>Injury Grade</th>
<th>Status</th>
<th>Approximate Expenditure (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>48/M</td>
<td>Thorn prick</td>
<td>III</td>
<td>2 16 18 20 22 23</td>
<td>Improved</td>
<td>1,50,500</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>40/F</td>
<td>Injury to foot</td>
<td>III</td>
<td>2 0 23 26 32 34</td>
<td>Recovered</td>
<td>1,15,000</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>75/M</td>
<td>Fall</td>
<td>II</td>
<td>2 13 21 26 31 35</td>
<td>Recovered</td>
<td>1,68,600</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>55/M</td>
<td>Wooden stick injury</td>
<td>II</td>
<td>28 26 33 36 40 42</td>
<td>Recovered</td>
<td>1,96,000</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>55/M</td>
<td>Injury to right hand</td>
<td>II</td>
<td>3 18 24 25 38 42</td>
<td>Recovered</td>
<td>1,53,500</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>61/M</td>
<td>Thorn prick</td>
<td>I</td>
<td>8 24 19 20 27 28</td>
<td>Recovered</td>
<td>1,48,500</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>50/M</td>
<td>Injury to right toe</td>
<td>II</td>
<td>16 1 0 14 21 29 31</td>
<td>Recovered</td>
<td>93,000</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>60/M</td>
<td>Ulcer on head</td>
<td>II</td>
<td>15 2 12 26 28 32 35</td>
<td>Recovered</td>
<td>1,37,500</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>51/M</td>
<td>Tooth extraction</td>
<td>I</td>
<td>2 4 4 14 15 23 25</td>
<td>Recovered</td>
<td>1,03,500</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>46/M</td>
<td>Thorn prick</td>
<td>IV</td>
<td>15 2 1 1 1 1</td>
<td>Death</td>
<td>8,600</td>
<td></td>
</tr>
</tbody>
</table>

**Graph 1**: Condition at the Time of Discharge

- **Recovered**: 75.0%
- **Improved**: 16.7%
- **Not Improved**: 8.3%

**Graph 2**: Approximate Expenditure Until Recovery (Rs)

Range: Rs. 93,000 – Rs. 1,96,000
Mean: Rs. 1, 48,181.82
SD: Rs. 33,965.65

Case 12 Died on the day of admission. Hence was not included in the statistical analysis of the approximate expenditure.
DISCUSSION

The impact of tetanus is found to be more prevalent in the lower socioeconomic group (6). They are all hard workers earning their daily wages. Thorn pricks is the most commonly observed cause of tetanus. Poor immunization status and poor wound care remains a major threat. Lack of awareness about tetanus immunization is the most pathetic situation among more than sixty percent of Indian population.

Male predominance is observed which explains that most of the field workers and farmers are males. All age groups are vulnerable to acquire tetanus. From neonate to old age, anyone can acquire the disease pertaining to poor hygiene and immunization status.

Although the incubation period [time between injury and first symptom] according to various authors ranges from one day to two months, our study showed similar results (7). The onset time [time between first symptom and first spasm] in our study was similar to the results of study by T M Cook et al (7). However, the duration of the incubation period and the onset time did not reflect on the duration of the disease and the hospital stay. Autonomic instability is a major complication of the disease process itself. Magnesium sulfate was widely used for its control (17, 18, 19). The toxicity of Magnesium was monitored by checking serum magnesium levels regularly and also by checking the patellar reflex whenever paralyzing agent was stopped intermittently. Serum Magnesium level was maintained well within the therapeutic range. Clonidine was also used to control autonomic instability and titrated according to needs of the patient (20, 22, 23). Labetalol was not used owing to its cost.

The outcome based on the severity at the time of presentation was remarkable. We report a 100% survival in patients presenting with grades I, II and III and a 50% survival rate in patients presenting with grade IV severity. These observations differed for the results of study done by Bansal R K et al who states that the mortality was 4.3% with grade I, 7.7% with grade II, 62.5% with grade III and 100% with grade IV (6).

Various complications were noticed during the course of the treatment apart from autonomic instability. Sepsis, acute respiratory distress syndrome and nosocomial infections were some of the common complication occurred in our study population.

With aggressive emergency and efficient critical care management, we found a successful outcome among tetanus patients. Follow up of these patients revealed that they were back to routine life except one patient who had developed weakness of limbs three months after discharge. Study by Trujillo et al who reported a reduction in mortality from 44 to 15% after the introduction of intensive care treatment (24). Study by Bansal R K et al observed a mortality of 31.6% and Masthi N R et al reported 31.25% deaths during the study period (6, 25). In comparison, we report a successful outcome of 91.7%. It was observed that the earlier the presentation, faster was the outcome and lesser the incidence of autonomic instability.

Most importantly counseling the patient and the patient attendants plays a major role. The nature of the disease, treatment, duration of treatment and approximate cost expenditure has to be explained. Explaining the daily prognosis to attendants is important to keep them encouraged.

Finally, the calculated approximate expenditure was directly proportional to the duration of the ICU stay, in hospital stay and the severity of the complications encountered. This cost is very high for a bread winner of the family in a low socioeconomic group. So educating the public regarding tetanus immunization should be encouraged. Prevention is better than cure.

Only limitation of the study is that it had a small study group. A larger group and a multi-centric study is required for more conclusive data.

CONCLUSION

The survival of patients with Tetanus is as high as 91.7% if early and aggressive management is initiated in the Emergency room and continued in the critical care along with prompt supportive care and counseling of the patient and family members.

REFERENCES


