Epidemiological trends of tetanus from East Delhi, India: A hospital-based study

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Abstract

Objective: To study the demographic profile, prognostic indicators, and mortality of tetanus patients and treatment outcomes following intramuscular anti-tetanus immunoglobulin (ATG) alone or combined intrathecal and intramuscular ATG.

Design: Retrospective study.

Setting: Inpatients from a tertiary care hospital.

Subjects: One hundred children under 12 years of age diagnosed with tetanus and admitted from January 2003 to December 2007 were included in the study.

Methods: Case records of patients with neonatal tetanus (n = 30) and post-neonatal tetanus (n = 70) were evaluated retrospectively. The diagnosis of tetanus was based on World Health Organization (WHO) criteria. The outcomes of patients treated with either intramuscular ATG or both intrathecal and intramuscular ATG were separately compared in the neonatal and post-neonatal groups.

Results: Our study revealed difficulty in feeding, trismus, spasms, rigidity, and opisthotonus posturing as the predominant clinical manifestations. The survival rate for children receiving tetanus immunoglobulin by the dual route was significantly higher than for children receiving the immunoglobulin via the intramuscular route. Seizures and tremors were poor prognostic factors associated with tetanus.

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Introduction

Tetanus is one of the most deadly diseases. It continues to cause approximately 213,000–293,000 deaths worldwide each year, 180,000 of which have been reported in neonates [1,2]. In India, tetanus is endemic and remains an important health problem. The annual incidence of neonatal tetanus is 1.74/1000 live births [3]. The exact incidence of non-neonatal tetanus in India is not known. Tetanus is the only vaccine-preventable disease that is not communicable; rather, it is acquired through environmental exposure to the spores of...
the bacterium *Clostridium tetani*. The incidence of the disease has been decreasing in the developed world, mainly due to effective immunization programs [1,2]. Presently, neonatal tetanus has been eliminated in 15 states and union territories in India [4]. Still, the complete eradication of neonatal tetanus is still a long way away. With increasing immunization coverage, the chances of eliminating tetanus have increased greatly. However, literature pertaining to the epidemiology of tetanus in Delhi is limited. Our study was designed to study the demographic profile, prognostic indicators, and mortality of tetanus and the treatment outcomes following intramuscular anti-tetanus immunoglobulin (ATG) alone or combined intrathecal and intramuscular ATG over a 5-year period.

**Methodology**

This retrospective, descriptive study was conducted in the pediatric department of a tertiary care hospital of East Delhi over a 5-year period between 1 January 2003 and 31 December 2007. Clearance was obtained from an institutional ethics committee. The study conformed to local regulation, Good Clinical Practices (GCP), applicable International Conference on Harmonization (ICH) guidelines, and the ethical principles of the Declaration of Helsinki.

The case records of 100 consecutive patients diagnosed with tetanus who were admitted to our hospital during this period and met the World Health Organization (WHO) case definition of tetanus were reviewed to gather information regarding demographic and clinical data, giving a mean of 20 cases per annum. Thirty cases of tetanus occurred in the neonatal age group, and 70 cases were post-neonatal tetanus. A case of neonatal tetanus was defined as one that had the following signs and symptoms occurring in sequence: history of normal suck and cry for the first 2 days of life, history of onset of illness between 3 and 28 days of age with inability to suck, stiffness, and/or convulsions. The diagnosis of post-neonatal tetanus was based on clinical features (i.e., presence of trismus, risus sardonicus, and/or provoked or unprovoked spasms). A structured proforma was used to record information. A brief history pertaining to maternal details of gestational age [as per last menstrual period (LMP)], mode of delivery, and delivery by an unskilled health professional was obtained for neonatal tetanus. Birth details regarding immunization, portal of entry, incubation period, period of onset, clinical features, treatment, complications, and outcomes were recorded in the case record form. Outcomes were based on whether the patient survived or expired. Patients who left against medical advice were excluded from the study. The objective of the study was to determine the demographic profiles, prognostic indicators, and mortality of tetanus patients, along with treatment outcomes following intramuscular ATG alone or combined intrathecal and intramuscular ATG.

The data were analyzed using SPSS version 13. All quantitative variables were compared using Student’s *t*-test, and categorical variables were analyzed using the Chi-square test or Fisher’s exact test. *P* < 0.05 was considered significant.

**Results**

Records of 30 cases of neonatal tetanus [20 (66%) males] and 70 cases of post-neonatal tetanus [44 (62.8%) males] were retrieved. Mortality outcomes were observed in 10 (33%) cases of neonatal tetanus and 9 (12.8%) cases of post-neonatal tetanus. The median age of presentation was 5.6 days in neonatal tetanus. Risk factors were identifiable in 28 (93.3%) cases of neonatal tetanus. The possible risk factors included unimmunized mothers, 22 (73.3%); unsterilized material used to cut the umbilical cord, 16 (53.3%); substance placed on the cord, 16 (53.3%); home delivery, 25 (83.3%); and delivery by an untrained professional, 26 (86.6%). Among 70 patients with post-neonatal tetanus, 64 (91.4%) had an identifiable acute injury (puncture wound or laceration [22 (31.4%)]) and ear discharge [42 (60%)].

Clinical presentations in neonatal tetanus (*n* = 30) included trismus [30 (100%)], spasms [29 (96.6%)], rigidity [25 (83.3%)], refusal to feed [13 (43.3%)], and tremors [10 (33.3%)]. Similarly, presentations in the post-neonatal group included trismus [65 (92.8%)], difficulty in feeding [55 (78.6%)], opisthotonos posturing [51 (72.8%)], risus sardonicus [36 (51.4%)], seizures [8 (11.4%)], and unconsciousness [63 (90%)]. Among the 30 cases of neonatal tetanus, 13 (43.3%) patients received the entire dose of human ATG (500 IU) as an intramuscular injection, whereas 17 (56.6%) patients received 50% of the human ATG dose via the intrathecal route and the other 50% of the dose via the intramuscular route. Among children with post-neonatal tetanus (*n* = 70), 5 children (7.1%) required mechanical ventilation, 22 (31.4%) underwent wound debridement, 28 (40%) received the entire dose of ATG via the intramuscular route, and the other 42 (60%) received half of the dose via the intramuscular route and the other half of the dose via the intrathecal route. We observed...
that mortality was higher in children who received ATG via the intramuscular route alone for both neonatal tetanus \(P = 0.002\) and post-neonatal tetanus \(P = 0.025\) (Table 1).

### Discussion

The global efforts for neonatal tetanus elimination have resulted in 157 countries with less than 1 case of neonatal tetanus per 1000 live births per district, but neonatal tetanus elimination remains a major problem in 57 countries, including India [1,2]. Each case of neonatal or post-neonatal tetanus represents the failure of the health services to provide not only routine immunizations but also routine antenatal and postnatal care. WHO, the United Nations Children’s Fund (UNICEF), and the United Nations Population Fund (UNFPA) advocate the “high-risk approach” to eliminate neonatal tetanus, which involves identifying districts at highest risk within countries and focusing interventions in those areas. Our study was designed to study the demographic profiles, prognostic indicators, and predictors of tetanus-related mortality over a 5-year period.

Our study implicated difficulty in feeding, trismus, spasms, rigidity, and opisthotonus posturing as the predominant clinical manifestations in the neonatal group. In the post-neonatal age group, ear discharge was present in 60% of patients, and history of acute injury was noted in 31% of patients. In a study conducted in Malaysia predominantly involving patients in older age groups who were diagnosed with tetanus over a 10-year duration, body stiffness, trismus, and dysphagia were the three most common manifestations of tetanus. Nearly 81% patients had an identifiable history of acute injury [5].

We noted that the survival rates in children receiving tetanus immunoglobulin via the dual route were significantly higher than the rates for children who received the immunoglobulin only intramuscularly. Although standard textbooks do not currently recommend intrathecal ATG administration, studies have demonstrated that the intrathecal route of ATG administration is superior to the intravenous and intramuscular routes [6,7]. Direct administration of intrathecal ATG would bind faster to the toxins released by \(C.\) tetani in central nervous system as compared to ATG injected by other routes. A potential limitation of this study is that it is a retrospective study. However, the results of the study prompt us to conduct a prospective study. A study conducted in Brazil with over 120 subjects showed better clinical progression \(P = 0.005\) in patients who received ATG via the combined intrathecal and intramuscular route compared to the intramuscular route alone [6]. The durations of spasm occurrences, hospital stays, and respiratory assistance were also shorter. Another meta-analysis of 12 trials conducted with over 942 patients reported the combined risk ratio of mortality for the intrathecal versus the intramuscular route to be 0.71, thus implicating intrathecal therapy as more beneficial [7]. The only advantage of the intramuscular route is easy administration, whereas intrathecal administration requires skilled staff.

Further, our study has shown seizures and tremors to be poor prognostic factors in the post-neonatal and neonatal age groups, respectively. A study conducted in Ethiopia indicated that the non-neonatal age group was associated with poor outcome in patients with an onset of 48 h or less and in patients presenting within 72 h of onset [8]. In the neonatal age group, an onset of 48 h or less, an incubation period of less than 7 days, tachycardia [heart rate (HR) > 140 beats/min], and the presence of fever were associated with poor outcomes. A retrospective study analyzed 55 cases of neonatal tetanus over a 5-year duration and noted that the poor prognostic factors were lower birth weight, younger age at symptom onset and at the time of admission, and the presence of opisthotonus and risus sardonicus [9].

This study summarizes increased mortality in the neonatal period. Non-immunization of mothers with tetanus toxoid, delivery by an untrained health professional, and the use of unsterilized material

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intramuscular alone</th>
<th>Both intramuscular and intrathecal</th>
<th>(P) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonatal tetanus ((n = 30))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivor ((n = 20))</td>
<td>5 (38.5%)</td>
<td>15 (88.2%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Non survivor ((n = 10))</td>
<td>8 (61.5%)</td>
<td>2 (11.8%)</td>
<td></td>
</tr>
<tr>
<td>Post-neonatal tetanus ((n = 70))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivor ((n = 61))</td>
<td>21 (75%)</td>
<td>40 (95.3%)</td>
<td>0.025</td>
</tr>
<tr>
<td>Non survivor ((n = 9))</td>
<td>7 (25%)</td>
<td>2 (4.7%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Table comparing the outcomes of ATG administration via the intramuscular route alone and via both the intramuscular and intrathecal routes in neonatal and post-neonatal tetanus.
on the umbilical cord are the main risk factors for the occurrence of neonatal tetanus. This study further adds that a combination of intramuscular and intrathecal tetanus immunoglobulin administration serves as a better modality for reducing mortality in neonatal and post-neonatal tetanus.

Conclusion

To conclude, a combination of intrathecal and intramuscular anti-tetanus immunoglobulin is a superior modality to intramuscular administration alone in reducing the mortality of tetanus in any age group.

Contributions

AK collected the data. MN was involved in study design, critically analyzed the results and finalized the manuscript. NC drafted the paper and searched the literature. SG was involved in study design. All authors approved the final manuscript.

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Competing interest

None declared.

Ethical approval

Not required.

References