Original Research Article

Epidemiological and clinical aspects of neonatal tetanus from a tertiary care hospital

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Received 5 September 2016; received in revised form 12 October 2016; accepted 16 October 2016
Available online 11 January 2017

Keywords
Tetanus; Neonate; Maternal; Prevention

Abstract  Background and objectives: To study the epidemiology, clinical presentation and outcome of all patients diagnosed with neonatal tetanus and to provide a recommendation for maternal and neonatal tetanus elimination.

Design and setting: Retrospective study of all cases of neonatal tetanus admitted from 1991 to 2013.

Neonatal intensive care unit, King Fahad Central Hospital, Jazan, Saudi Arabia.

Results: Thirty patients were diagnosed with neonatal tetanus over 22 years. Eighteen (60%) of the patients were born to Saudi mothers, and 12 (40%) were born to non-Saudi mothers. Twenty-seven (90%) deliveries occurred at home. Most of the mothers lived in the mountainous zone of the region. Two (10%) of the mothers had only a single dose of the tetanus toxoid; the status of the remaining pregnant women was unknown or unimmunized before or during conception. In 18 of the 30 patients (60%), the umbilical cord was severed using household knife, razor blade or plain scissors. Most of the patients presented with muscle spasms (96.7%), refusal to eat and abnormal posture. All of the patients were intubated and receiving mechanical ventilation. Six (20%) of the patients died.

Conclusion: It is essential to begin campaigns or integrate complete maternal tetanus toxoid immunization at primary health centers (PHC) during antenatal care. Immunization needs to be arranged so pregnant women can be educated regarding the importance of ANC and the...
risks of unhygienic home delivery, and immunization should be addressed with adequate information. Pregnant women and those of childbearing age in mountainous areas should be the first targets for these activities.

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1. Introduction

Neonatal tetanus (NT) is a potentially life threatening disease that is still a health problem in many developing countries. In 2010 and 2013, it was estimated that 58,000 and 49,000 deaths, respectively, occurred from NT worldwide [1,2]. The disease is caused by tetanoplasmin, a neurotoxin liberated by anaerobic, spore forming, gram-positive Clostridium tetani. The organism contaminates the umbilical cord or its stump following the use of unhygienic instruments or materials during or after delivery [2]. NT is a preventable disease [3]. Maternal tetanus toxoid immunization is the primary prevention. Neonates receive passive immunity from their vaccinated mothers. In addition, delivery in healthcare centers, avoiding unhygienic childbirth practices and some social taboos and perhaps providing sterile instruments for mothers who elect to have home delivery are important preventive measures [3,4].

The diagnosis of NT is clinical. For surveillance purposes, a confirmed case is defined as any neonate with a normal ability to suck and cry during the first two days of life but who no longer sucks normally between 3 and 28 days and becomes stiff or has spasms [5].

Except for one report of tetanus in adult patients, there are no published data on NT from Saudi Arabia. However, over the last five years, 2009–2013, it was estimated that 3,215 and 3,762 deaths, respectively, occurred from NT worldwide [6,7]. The mean number of cases reported to the World Health Organization (WHO) was 10.4, with a range of 4–14 patients [5,6]. This report reviews the clinical aspects and outcomes of NT cases treated in our institution over the last 22 years. The objective is to draw attention to this preventable disease with the hope of collecting more epidemiologic data and developing a national plan for eliminating NT. This study was approved by the KFCH research ethics committee.

2. Patients and methods

This is a retrospective study of all patients who were admitted to the Neonatal Intensive Care Unit (NICU) at KFCH, Jazan, Saudi Arabia. The NICU is a 25-bed unit and is the major unit that provides critical care in this province. All suspected NT patients are referred from peripheral hospitals to the NICU at this institution. Babies were included if they were younger than 28 days of age as per the definition of confirmed NT by the WHO. The study covered the period between January 1991 and December 2013.

All medical records of patients with a diagnosis of NT were reviewed to collect information about socio-demographic characteristics including gestational age, birth weight, sex, nationality, area of residence, antenatal care of the mother and immunization against tetanus, location of delivery, attendance of the birth by medical or paramedical staff and the instruments used to cut the umbilical cord. The clinical aspects of the patients were obtained upon admission, including the signs and symptoms on presentation and the management provided. Management included mechanical ventilation and its duration and the medications used for paralysis, sedation and controlling convulsions. The outcomes (either death or discharge) and the neurological examination results for the latter group were also recorded. Non-parametric calculations were used.

3. Results

A total of 30 cases of NT were admitted to the NICU of KFCH over a period of 23 years. A total of 21 (70%) cases were recorded in the first 10 years of the study (1991–2000), with 1–4 cases per year and an average incidence of 0.47 cases per year. A frequency of zero-two cases per year and an average tetanus incidence of 0.19 per year were observed in the subsequent 13 years of the study. The highest number — four patients — was recorded in 1994. The socio-demographic characteristics of these patients

| Parameter                  | Number | %    |
|----------------------------|--------|------|
| Full-term pregnancy        | 28     | 93.3 |
| Preterm                    | 2      | 6.7  |
| Saudi                      | 18     | 60   |
| Non-Saudi                  | 12     | 40   |
| Residence in mountains     | 23     | 76.7 |
| Other areas                | 7      | 23.3 |
| Antenatal care             | 4      | 13.3 |
| No antenatal care          | 26     | 86.7 |
| No Tetanus toxoid          | 27     | 90   |
| TT, one dose               | 3      | 10   |
| TT2+                       | 0      | 0    |
| Home delivery              | 27     | 90   |
| Healthcare center          | 3      | 10   |
| Attended                   | 2      | 6.7  |
| Not attended               | 13     | 43.3 |
| Not documented             | 15     | 50   |
| Home-instruments used      | 18     | 60   |
| to cut umbilical cord      | 12     | 40   |

*Labor is attended by trained healthcare worker.*
and their mothers are shown in Table 1. Eighteen (60%) of the patients were born to Saudi mothers, and 12 (40%) were born to non-Saudi mothers. Of the non-Saudi mothers, 11 were from Yemen and one was from Ethiopia. Twenty-seven of the deliveries occurred at home (90%). Of note, most of the mothers lived in the mountainous zone of the region and only two (6.7%) had a single dose of the tetanus toxoid.

The remaining 28 pregnant women were not immunized before or during conception, or their immunization status was unknown [7]. Forty-three percent of the births were not attended by any medical or paramedical staff, while in 15 (50%), the attendance of home delivery by healthcare staff was not documented in the patients’ records.

In 18 of the 30 patients (60%), the umbilical cord was severed using a household knife, razor blade or plain scissors. The clinical presentation and management of the patients are depicted in Table 2. Most of the patients presented with muscle spasm (96.7%), refusal to eat and abnormal posture. On physical examination, 27 of the 30 patients (90%) had an unhealthy umbilical stump. All cases were intubated and received mechanical ventilation. The mean duration of ventilation was 27 days (range 16–51). All the patients received tetanus immune globulin (TIG) in doses ranging from 250 to 4500 units. All the patients were treated empirically with crystalline penicillin and gentamycin. To control muscle spasms, 80% of the patient required the muscle relaxant pavulon. The complications and outcomes of the patients are shown in Table 3. Six (20%) of the patients died.

### 4. Discussion

Neonatal tetanus (NT) is a potentially life-threatening disease that is still a health problem in many developing countries. It leads to significant mortality among affected patients: up to 80% of affected babies die, particularly in areas where pregnant women have poor access to the health care system [8]. Since 2009, both the total number of tetanus and NT cases in Saudi Arabia have been regularly reported to the WHO, and NT patients have accounted for 40–66% of the total [6]. The majority (60%) of the patients in this study were born to Saudi mothers, and 40% were born to non-Saudi mothers. Apart from one patient, all the non-Saudi mothers were from Yemen and had crossed the border illegally. These mothers usually live far from health centers and are non-immunized.

The fact that 90% of our patients were delivered at home reflects that these pregnant women prefer home delivery but not aware of the complications that unexpectedly may arise, including NT. The majority (86.7%) of these women received no antenatal care. Only 6.7% of the home deliveries were attended by a trained health care worker, 43% were unattended, and in 50%, no information about whether a health care worker was present was recorded in the patient’s medical chart. Educating pregnant women and women of child-bearage in high-risk areas during antenatal care is paramount to raising their awareness of delivery at health care centers or at least having a trained assistant if home delivery is unavoidable. It seems that counseling on important vaccines for pregnant women is not adequately provided by health care personnel. The primary health care centers (PHCs) may not provide sufficient information to pregnant women, particularly regarding the importance of immunization, including the tetanus vaccine. These issues were addressed in a study that included a sample of PHCs in Al Khobar City in Eastern Province, Saudi Arabia [9]. The mean age of patients at the onset of disease was 7.2 days, and the range was 3–10 days. The most common clinical features were muscle spasms (97.6%), refusal to eat (73.3), abnormal posture (63.3%) and fever (40%). The clinical presentation of our patients was not different from that indicated in other previous reports [10,11]. The hospital stay ranged from 9 to 73 days, with a mean of 46.2 days. This long stay was associated in some patients with invasive health care-associated infections, such as pneumonia and septicemia.

It is the current protocol of the NICU at KFCH to intubate and ventilate most patients with a diagnosis of NT based on reports of improved outcomes with this intervention [12,13]. Therefore, 96.7% of the patients were ventilated, with a duration ranging from 16 to 51 days. The most frequent clinical complications were pneumonia, observed in 33.3% of patients, followed by difficulty feeding and septicemia. Six (20%) of the 30 patients died. We were unable to determine the direct cause or causes of death by reviewing the medical charts. However, the leading causes

| Symptom, sign, therapy | No. of patient | Percentage (%) |
|------------------------|----------------|----------------|
| Muscle spasm           | 29             | 96.7           |
| Refusal of feeding     | 22             | 73.3           |
| Abnormal posture       | 19             | 63.3           |
| Fever                  | 12             | 40             |
| Convulsions            | 11             | 36.7           |
| Apnea                  | 4              | 13.3           |
| BW more than 2.5 kg    | 20             | 66.7           |
| BW Less than 2.5 kg    | 10             | 33.3           |
| Unhealthy umbilicus    | 27             | 90             |
| Tetanus antitoxin      | 30             | 100            |
| Mechanical ventilation | 30             | 100            |
| Pavulon                | 24             | 80             |
| Diazepam               | 19             | 63.3           |
| Phenobarbitone         | 10             | 33.3           |
| Antibiotics            | 30             | 100            |

**Table 2** Clinical features on admission and therapeutic interventions used in 30 patients with neonatal tetanus.

| Complication/outcome   | Number | Percentage (%) |
|------------------------|--------|----------------|
| Pneumonia              | 10     | 33.3           |
| Feeding difficulty     | 7      | 23.3           |
| Septicemia             | 6      | 20             |
| Air leak               | 3      | 10             |
| Meningitis             | 1      | 3.3            |
| Discharge              | 24     | 80             |
| Death                  | 6      | 20             |

**Table 3** Complications and outcome of 30 patients with neonatal tetanus.

BW = Birth Weight.
are usually respiratory complications and health care-associated infections [13]. In a series of 125 patients from Iran, 75 patients died. Bronchopneumonia was the leading cause of mortality. Hypothermia, decreased need for sedation and diminished signs of tetanus usually indicate the onset of bronchopneumonia. Eighty-five percent of 54 patients who underwent necropsy had pulmonary pathology, including pulmonary hemorrhage, bronchopneumonia and aspiration pneumonia [7]. This is a retrospective review with its own limitations. Some data were missing from the patients’ medical records; for example, information regarding maternal immunization, attendance of the delivery and causes of death was not recorded.

5. Conclusion

NT, though sporadic, still exists in Saudi Arabia. The number of cases reported to the WHO is small, which will encourage the elimination of the disease. There is a need for more epidemiological data on NT nationwide. Until these data are available, it is essential to start campaigns or integrate complete maternal tetanus toxoid immunization at PHCs during antenatal care. The integration of immunization into antenatal care needs to be rearranged so that pregnant women are educated regarding the importance of ANC and the risks of home delivery and the importance of immunization are addressed with adequate information. Pregnant women and those of child-bearing age in mountainous areas should be the first targets for these activities. Proper documentation of the history of NT patients, including maternal immunization and details regarding home delivery, is essential.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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