

Epidemiological, Clinical and Outcome Aspects of Care-Related Tetanus in Dakar, Senegal

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Abstract

Introduction: Tetanus portals of entry are numerous. Amongst these, the care-related portals of entry are rarely reported. The aim of the study was to describe the epidemiological, clinical and outcome aspects and identify the factors associated with death from care-related tetanus. **Patients and Methods:** This is a retrospective study of descriptive and analytical purposes. Data were collected from the medical records of patients admitted to the Infectious and Tropical Diseases Department of the National University Hospital Center (CHNU) of Fann in Dakar for care-related tetanus during the period ranging from 1 January 2009 to 31 December 2016. Care-related tetanus was defined as any case of tetanus occurring after a surgical procedure, including circumcisions performed even outside a health facility. **Results:** In eight years, 50 cases of care-related tetanus were recorded. Care-related tetanus accounted for 6.7% of hospitalized tetanus cases. The mean age of patients was 21 ± 22 years, with a male predominance (sex ratio: 6.14). The procedure had been performed in most cases, either in a health facility in 22 patients (44%) or at home in 16 patients (32%), and occurred after circumcision. In 62% of cases the portal of entry was urological, followed by orthopedic surgery (14%) and visceral surgery (10%). The procedures performed were dominated by circumcision (31 cases), limb amputation (3 cases) and inguinal hernia repair (2 cases). Tetanus was immediately generalized on admission in all patients. Eighty-four percent (84%) of patients were admitted with Mollaret stage II. Cardiovascular (11 cases), infectious (10 cases) and respiratory (9 cases) complications were the most frequent. The hospital case fatality rate was 24%. Factors associated with death were female gender ($p = 0.03$), age between 15 -

60 years ($p = 0.02$), incubation time < 7 days ($p = 0.003$), presence of complication ($p = 0.001$). **Conclusion:** Care-related tetanus remains a concern in poor income countries, particularly in Senegal. The drop of these cases will require better immunization coverage of the population. It is also appropriate to raise the awareness of health care providers and surgeons and to promote capacity building for better prevention of cases through sero-immunization of patients at risk before the procedure and rigorous asepsis.

Keywords

Tetanus, Care, Surgery, Dakar, Senegal

1. Introduction

In poor income countries, particularly in Africa, tetanus remains a public health concern due to its frequency and severity despite the existence of effective immunization [1]. Tetanus remains a public health problem in developing countries with an annual incidence rate of 10 to 50 per 100,000 population [2] [3]. Senegal is one of the African countries where tetanus in children and adults remains a concern, despite the efforts made through the expanded programme on immunization [4] [5] [6]. Despite the relevant experience acquired in the management of tetanus in hospitals, the lethality remains high (20% to 30%) [4] [7], due to the impact of several unknown factors that influence the prognosis of the disease [8] [9]. Tetanus portals of entry are numerous. Amongst these, the care-related portals of entry are rarely reported. Tetanus can result from any surgical procedure and has a very poor prognosis because of its severity and high mortality rate, which can reach 50% [10] [11]. Previous studies carried out in Senegal and elsewhere in Africa [11] [12] [13] [14] show that tetanus following surgery is a reality. It represents a medical scandal and poses a medico-legal concern. It features a higher lethality compared to certain portals of entry. Our study aimed to describe the epidemiological, clinical, and outcome aspects of care-related tetanus and to identify the factors associated with death in these patients.

2. Patients and Methods

This is a retrospective study of descriptive and analytical purposes carried out on the medical records of patients hospitalized for tetanus over an 8-year period range from 1 January 2009 to 31 December 2016 in the infectious and tropical diseases department of National University Hospital Center (CHNU) in Dakar, Senegal. It is the referral service for the management of patients with tetanus in Senegal. We included patients hospitalized for care-related tetanus. We defined care-related tetanus as any case of tetanus occurring after a surgical procedure, including circumcisions performed even outside a health facility. We did not include cases of neonatal tetanus in this study. The diagnosis of tetanus relied on

epidemiological (presence of portal of entry, absence of immunization or notion of incomplete immunization), clinical (presence of trismus associated or not with dysphagia, contractures and/or paroxysms). Tetanus diagnosis was purely based on clinical features. Data were collected on an individual survey form from the patients medical records and hospital registers. They involved socio-demographic aspects (sex, age, geographical origin, tetanus vaccine status, type of surgery, type of procedure performed); clinical aspects (incubation period, invasion period, clinical pattern); prognostic aspects (Mollaret stage classification and Dakar score) and outcome aspects (complications, recovery, death, transfer). Data entry and processing were carried out using Epi-info software version 7.1.2. The categorical variables were described by the number and frequency in each class. Graphs were performed in excel. For the univariate analysis, the Pearson Chi-square test or the Fischer test was used to search for factors associated with the occurrence of patient death. A p-value of <0.05 was used as a significance threshold.

3. Results

3.1. Epidemiological Aspects

During the study period from 2009 to 2016, we studied 741 cases of tetanus from all admissions (8306 patients) and 50 cases of tetanus related to care, accounting for a hospital prevalence of 0.6% (50/8306) and a proportional morbidity of 6.7% (50/741). Annual variations over the years were noted (**Figure 1**). The average number of cases was 6.3 per year. There was a clear male predominance with a sex ratio of 6.14. The mean age of the patients was 21 ± 22 years with extremes of 6 months and 74 years. Among the patients, 62% were aged 1 - 15 years (**Table 1**). The majority of patients were from Dakar suburb (62%). Twenty eight patients, standing for 56% of the cases, didn't undergo tetanus sero-immunization neither before nor after the procedure. Information on the place of intervention

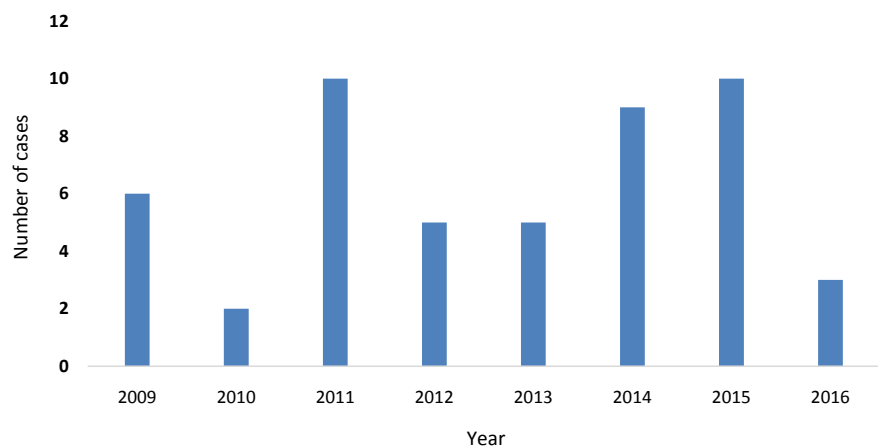


Figure 1. Annual distribution of care-related tetanus cases at the Infectious and tropical diseases department of Fann University Hospital center in Dakar-Senegal, from 2009 to 2016.

Table 1. Characteristics of patients admitted for care related tetanus at the Infectious and tropical diseases department of Fann University Hospital center in Dakar-Senegal, from 2009 to 2016.

Variables	Number of cases	Percentage (%)
Age group (year)		
<1	1	2
1 - 15	31	62
16 - 60	12	24
>60	6	12
Sex		
Male	43	86
female	7	14
Tetanus sero vaccination		
realized	2	4
Not realized	28	56
Not specified	20	40
Surgery type		
Urology	31	62
Orthopedics	7	14
Digestive	5	10
Others (gynecology, ORL,)	7	14
Incubation period		
<7 days	10	20
≥7 days	40	80
Invasion period		
<48 hours	26	52
≥48 hours	24	48
Symptoms		
Trismus	50	100
Dysphagia	37	74
Tonic paroxysm	30	60
Tonic clonic paroxysm	4	8
Mollaret stage		
Stage I	4	8
Stage II	42	84
Stage IIIa	1	2
Stage IIIb	3	6
Outcome of hospitalization		
Recovery	36	72
Transfer	2	4
Death	12	24

was available for 38 patients (76%). The procedure was performed in most cases, either in a health facility in 22 patients (44%) or at home in 16 patients (32%) and represented cases of circumcision. In two-third of the cases 31/50 patients (62%) the infection portal of entry was urological, followed by orthopedic surgery (7/50 cases) and visceral surgery (5/50 cases) with 14% and 10% of cases respectively. The procedure performed was dominated by circumcision (31 cases), limb amputation (3 cases) and inguinal hernia repair (2 cases). The different procedures performed are detailed in **Table 2**.

3.2. Clinical, Prognostic and Outcome Aspects

In 80% of cases the incubation period was equal to or longer than 7 days and the invasion period was less than 48 hours in 52% of patients. Tetanus was immediately generalized in all patients. Trismus (100%) and dysphagia (74%) were the main clinical signs. More than two-third of the patients (68%) underwent paroxysms. Mollaret stage II was found in 84% of patients on admission (**Table 1**). A score between 2 - 3 of the Dakar international classification was found in 78% of the patients and in 4 patients this score was higher than 4, including two circumcisions, a cure for vesicular lithiasis and nasal vegetation.

Table 2. Surgery type and act performed of patients admitted for care related tetanus at the infectious and tropical diseases department of Fann University Hospital center in Dakar-Senegal, from 2009 to 2016.

Type of surgery	Procedure performed	Number of cases
Urology	circumcisions	31
	limb Amputation	3
	osteosynthesis	1
Orthopedic	installation of a screwed plate	1
	leg abscess drainage	1
	fracture surgery	1
Digestive	inguinal hernia repair	2
	appendectomy	1
	Grelic resection and ileostomy	1
	Cure fo vesicular lithiasis	1
ORL and Stomatology	nasal vegetations cure	1
	naso sinus Polyp rfemoval	1
	laser procedure	1
	dental extraction	1
Gynecology	hysterectomy	1
	dermoid cyst surgery	1
Oncology	breast biopsy	1

During hospitalisation, 22 patients (44%) had undergone at least one complication. Cardiovascular (11 cases), infectious (10 cases) and respiratory (9 cases) complications were the most common. Infectious complications were dominated by pneumonia (12%), sepsis (12%) and urinary tract infections 4%. Among the cases of bacterial pneumopathy, *Pseudomonas aeruginosa* was found in one patient. For the 6 cases of septicaemia that occurred, the blood culture isolated *Staphylococcus saprophyticus* in one patient and *Staphylococcus aureus* in two cases. Regarding urinary tract infections, cytobacteriological examination of the urine isolated *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*. Cardiovascular complications were mainly represented by heart attack (10%) and rhythm disorders (8%). Respiratory distress (8%), laryngospasm (8%) and apnoea (8%) were the main respiratory complications.

3.3. Lethality and Factors Associated to Death

Among the 50 patients, the outcome was fatal for 12 (24%). Death mainly occurred after septic shock (5 cases) and heart attack (4). Poor prognostic factors included female gender ($p = 0.03$), age between 15 and 60 years ($p = 0.02$), incubation < 7 days ($p = 0.003$) and the presence of a complication ($p = 0.001$) (Table 3).

Table 3. Factors associated with death of patients admitted for care related tetanus at the Infectious and tropical diseases department of Fann University Hospital center in Dakar-Senegal, from 2009 to 2016.

Variables	Death		p value
	Yes N (%)	No N (%)	
Age group (years)			
<15	4 (12.5)	28 (87.5)	0.02
15 - 60	3 (60.0)	2 (40.0)	
>60	5 (32.5)	8 (61.5)	
Sex			
Female	4 (57.1)	3 (42.9)	0.03
Male	8 (18.6)	35 (81.4)	
Type of surgery			
Urology	4 (12.5)	28 (87.5)	0.08
Viscéral	3 (60.0)	2 (40.0)	
Others *	5 (32.5)	8 (61.5)	
Incubation period			
<7 days	6 (60)	4 (40)	0.03
≥7 days	6 (15)	34 (85)	
Invasion period			
<48 hours	9 (34.6)	17 (65.4)	0.07
≥48 hours	3 (12.5)	21 (87.5)	

Continued

paroxysm			
Present	7 (21.9)	25 (78.3)	0.63
Absent	5 (16.7)	13 (72.2)	
Mollaret stage			
Stage I	3 (75.0)	1 (25.0)	0.47
Stage II	7 (16.7)	35 (83.3)	
Stage IIIa	0 (0.0)	1 (100)	
Stage IIIb	2 (66.7)	1 (33.3)	
Existence or not of tares			
Yes	3 (37.5)	5 (62.5)	0.09
No	3 (11.5)	23 (88.5)	
Not specified	6 (37.5)	10 (62.5)	
Complications			
Yes	10 (45.5)	12 (54.5)	0.001
No	2 (7.1)	26 (92.9)	

4. Discussion

Tetanus remains a concern in Senegal. Care-related portal of entry is scarcely reported but constitutes a reality in our poor income countries [11] [13] [14]. The proportional morbidity of 6.7% found in our study is higher than that of a previous senegalese series which found a rate of 1.75% [11] and lower than that of an Ivorian series which was 11% [14]. This difference in prevalence is due to methodological approaches such as the non-inclusion of circumcision cases in the Senegalese study and the inclusion of surgical wounds in the Ivorian study. Fortes in 2015 in the same department [15] and Ngaha [16] in Burkina Faso in 2014 found in their various studies that the post-surgical portal of entry ranked second after the integumentary portal of entry with respectively 7% and 11.1%. These results prove the fact of care-related tetanus in our hospitals and should therefore be of concern to all health care providers. The male predominance noted in our study with a sex ratio of 6.14 is reported in most African series, whatever the age group and tetanus clinical pattern [5] [7] [8] [14]. Care-related tetanus in our series affected more children between 1 and 15 years of age. This is explained by the high frequency of circumcision in our series (31 cases), which is more often performed in this age group. These results also show that the immunization schedule, which protects children up to the age of 10, is not respected. Furthermore, booster shots are not usually given because they are under the charge of parents.

Serotherapy and tetanus immunization were not performed neither before nor after the procedure in 56% of cases. However, in our countries where tetanus remains a health concern, practitioners should seize every opportunity to update

both serotherapy and tetanus immunization if necessary in order to improve immunization coverage. Despite the tetanus serotherapy carried out in an Ivorian study, 59% of patients had developed tetanus following surgery [14], hence the interest in combining tetanus vaccination in high-risk patients [17].

The urological portal of entry was the most common route with 62% of cases represented solely by circumcisions in our series (31/50 cases). Circumcisions constitute an entry point, particularly those performed outside a health facility. In this case, the occurrence of tetanus would be due to circumcision being performed by unqualified personnel or by a caregiver practising at home under precarious aseptic conditions. After the circumcisions, the other procedures were multiple, dominated by limb amputations (3 cases), the installation of osteosynthesis material or a screwed plate (2 cases) and inguinal hernia repair (2 cases). These data are similar to those of Dia [11] who found a predominance of urological (42%) and orthopedic (29%) surgery with inguinal hernia repair and amputations as the main procedures performed. In contrast to our study, the cases of tetanus after urological surgery were secondary to prostatectomies, internal urostomy and hydrocele cure in this study.

Elsewhere, Aba [14] in Ivory Coast reported 6 cases of tetanus due to inguinal hernia repairs and cases of breast tumour removal, Fournier's gangrene, and skin abscesses. In Guinea, [13] in a study of nosocomial tetanus, Traoré noted 16 cases secondary to hernia repair, 7 cases following amputation and 2 cases due to prostatectomy. It is important to note that tetanus can also occur after minor surgical procedures. We have recorded one case of tetanus after breast biopsy. Regarding gynecological portal of entry, our study revealed that tetanus occurred after hysterectomy and dermoid cysts cure, contrary to the work of Manga in Senegal [6] and Douchi in Niger [18], where the cases recorded were following abortion.

Clinically, generalized tetanus found in our series is in line with the data of Aba [14] who reported the same course with the presence of a tight trismus, generalized muscle contractures and more or less sub-intensive paroxysms. This demonstrates the severity of tetanus with a care-associated portal of entry as reported by other authors [13] [19] [20].

Regarding the outcome aspects, the predominance of cardiovascular, infectious and respiratory complications was comparable to that of Attinsounon [21]. Infectious complications were mainly represented by pneumopathy and septicaemia. These results corroborate with those of Fortes in Dakar where pneumopathies represented 63% of infectious complications followed by septicaemia (17%) [15]. In the intensive care unit, pulmonary infections are frequently observed and are most often nosocomial [22]. Moreover, during tetanus, decubitus, salivary stasis, damage to smooth muscles, particularly laryngeal muscles, and contracture of the thoracic muscles are factors that favour inhalation pneumonia.

Advanced age has been reported by several authors [9] [14] [23] as a factor associated with the risk of death as found in our study. The fragility and the

presence of an underlying condition explain this high mortality. The presence of complications in our series was correlated with an increase in lethality ($p = 0.001$). These results are similar to those of Seydi [7] and Manga [24] who found that the presence of complications and the nature of the portal of entry were related to death. These data also confirm the relevance of the elements taken into account in the two classifications of tetanus to assess the prognosis of patients. However, they need to be updated by including some factors that have been identified in many studies as being associated with patient death, namely advanced age and complication occurrence [15]. The small size of our sample undoubtedly explains the fact that we did not find an association between death and the period of invasion, the presence of paroxysms and the surgical approach.

5. Conclusion

Care-related tetanus is still a concern in poor income countries, particularly in Senegal, with circumcision as the main portal of entry in our study. It is characterized by a high lethality. The reduction of cases will necessarily require better immunization coverage, in particular a strengthening of vaccination campaigns and booster shots for children over five years of age. It is also important to raise awareness among surgeons and to strengthen their capacities for better prevention of cases through vaccination and rigorous asepsis.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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