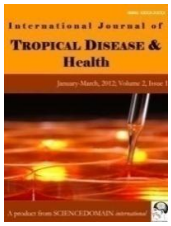

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An Eight-Year Review of Morbidity and Mortality among Adult Patients with Tetanus at a Tertiary Hospital in Zaria, Northern Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors ORO and DO did the study design and wrote the protocol. Authors EIA, SAA, JAK, EUI and PIC did the statistical analysis and literature searches while analyses of study were by authors EIA and ORO. All authors read and approved the final manuscript.

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ABSTRACT

Background: Tetanus infection is a major cause of morbidity and mortality in many developing countries. The infection results from contamination of wound by Clostridium tetani in unimmunized individuals. The morbidity is mainly due to sustained skeletal muscle spasms from unopposed action of tetanospamin on excitatory neurons in the central nervous system. The clinical presentation and outcome depend on both patient and disease factors. Health education and immunization would contribute to prevention and eradication of the infection. This review studied morbidity and mortality patterns among adults treated for tetanus at a tertiary hospital in Zaria from January 2006 to December 2013.

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Materials and Methods: Medical records of adults admitted with the diagnosis of tetanus were retrieved and reviewed. Information on socio-demography, clinical presentation, complications, co morbidities and outcomes were obtained and analysed using the Statistical Package for Social Sciences version 17.0.

Results: Forty-seven patients were admitted during the period, with an average of 6 patients per year. Male (70.2%): female (29.8%) ratio was 2.4: 1. Their ages ranged from 15 years to 65 years, the age group 20-39 years constituting 76.6% of the population. 51.2% were students. The lower limbs were portal of entry in 70.6% of cases, and 52.9% of the wounds were dirty. 82.4% of the patients were unimmunized and overall mortality was 40.4%. Predictors of mortality were short incubation period, short onset time, severe muscle spasms, non-immunization and presence of complications.

Conclusion: Tetanus remains a major preventable disease among unimmunized and low income people. Therefore, immunization of people at risk would prevent tetanus infection and its associated complications.

Keywords: Adult patients; morbidity; mortality; outcome; tetanus; Zaria.

1. INTRODUCTION

The word 'tetanus' comes from the Greek word, *tetanos,* which is derived from *teinein,* meaning to stretch [1,2]. Tetanus, commonly called 'lockjaw', is a vaccine preventable disease that remains one of the major public health hazards in the developing world [3,4]. It is endemic and is responsible for about 300, 000 deaths globally every year [5]. Tetanus is caused by *Clostridium tetani* bacterium, a gram positive rod which is an intestinal flora that forms spores in the soil, dust, animal and human faeces under anaerobic conditions [1,2]. The disease is mediated by tetanospasmin, an extremely potent exotoxin/ neurotoxin, released by the spores of *Clostridium tetani* bacterium when these come in contact with dirty and necrotic wounds [5-7].

The clinical presentation of tetanus can be either localised or generalised. Localised tetanus presents with rigidity and spasms of the muscles in the part of the body involved (most commonly cephalic tetanus which usually follow head injury or ear infection), whereas generalised tetanus typically presents with trismus or lockjaw, contraction of facial muscles (resulting in risus sardonicus), contraction of back muscles with characteristic arching of the back (opisthotonus), difficulty with swallowing and marked board-like rigidity of the abdomen along with spasms [8,9].

The outcome of tetanus depend on both patient and disease factors. Important patient factors are age and immunity status of affected individuals, as the disease occurs sporadically, usually affecting non-immunized persons, or partially immunized individuals who did not sustain their immunity with booster doses of the tetanus toxoid vaccine [10]. The efficacy of the tetanus toxoid in protecting individuals from tetanus has been recognized for many decades. Consequently, international and national health bodies have developed programs aimed at substantially reducing the burden of the disease through the active immunization of all individuals at risk [3,6,7,11]. These programs have had varying degrees of success in different countries judging by the population rates of protective antibodies levels [12], and the reduction in the number of reported cases of tetanus over time [6,7,13]. For instance, in Nigeria, the cross-sectional Health and Nutritional Survey conducted in 2012 showed that only 51% and 38% of the sampled children had received DPT1 and DPT3 respectively. The HNS report also showed that there were significant regional differences in the coverage rates between the northern and southern regions of the country, with DPT3 coverage in the north-west reportedly the lowest at 13.9% [14].

Yet, nationwide surveys and community studies on the incidence, patterns and outcome of tetanus in Nigeria are lacking. Instead most of the information on these parameters comes from tertiary hospital-based studies, which generally reported poor outcomes of tetanus characterized by high case fatality ratios, more in males than in females [15-23].

Mortality rates of tetanus in Nigeria have been reported to be in the range of 26% - 60% [17-22], approximately half of which were in neonates [22], and about 10% attributed to maternal tetanus in a study [14]. However, mortality is much lower in the developed countries because

of active immunizations and the availability of facilities for intensive care of cases [13,14].

Since the outcome of tetanus is known to be determined by the dose of toxin inoculums, portal of entry to the central nervous system, incubation period, clinical stage and onset time of symptoms, presence or absence of complications and previous vaccination status [10], this review determined the morbidity and mortality pattern of tetanus among adult patients admitted at our facility over an 8-year period.

2. MATERIALS AND METHODS

ABUTH is a 700-bed referral hospital located in Shika Zaria, Kaduna State. It serves a population of more than 15 million people spread across 10 states in northern Nigeria, the Federal Capital, Abuja and adjoining states in southern Nigeria. Depending on the severity of the illness [24], tetanus cases are usually admitted into the medical emergency unit, intensive care unit, and medical wards respectively; and managed by neurologists and anesthesiologists [25].

The case notes of all adult (≥15 years) tetanus patients admitted into the medical wards from January 2006 to May 2013 were retrieved and reviewed using standardized data extraction form arranged to capture details such as: demographic characteristics, clinical presentations and related complications, pre-morbid immunization status and treatment outcome. The severity of tetanus was graded using the Ablett's criteria [24], as:

i. Mild (grade 1), when patient had trismus and generalised spasticity only;
ii. Moderate (grade 2), when patient had trismus, generalised spasticity, dysphagia, spasms, and occasionally respiratory embarrassment;
iii. Severe (grade 3a), when patient had worsening of grade 2 features plus respiratory embarrassment; and
iv. Very severe (grade 3b), when patient had marked autonomic dysfunction, in addition to above features.

The data were analyzed using the Statistical Package for Social Sciences (SPSS), version 20.0, Chicago, IL USA. Descriptive statistics-frequency distributions, median, range, percentages, and proportions were determined. The incubation period (IP) was converted to a qualitative variable by grouping the patients into those with an IP of ≤7 days and those with an IP of ≥8 days. Likewise, the onset time (OT) was converted to a qualitative variable by dividing patients into those with OT ≤24 hours and those > 24 hours. The OT, IP and presence of complications were compared using the Fisher's exact test, while the significance of severity of disease was determined using likelihood ratio. Levels of significances were determined at 95% confidence interval and set at 5% probability ($p < 0.05$).

3. RESULTS

A total of 47 patients were admitted into the medical wards during the period under review, approximating to 6 patients per year. 33 (70.2%) were males while 14 were (29.8%) females, with a male to female ratio (M: F ratio) of 2.4:1. The mean age of all patients was 26.5±16.0 years, with a range of 16 – 65years. The majority (76.6%) were within the age range of 20 – 39 years, as shown in Table 1.

3.1 Occupation

24 (51%) of the patients were students, followed by farmers (6, 12.8%), traders (6, 12.8%), drivers (6, 12.8%) and house wives (5, 10.6%).

Table 1. Age and sex distribution of tetanus patients in ABUTH Zaria

Age group	Gender		Total (%)
	Male (%)	Female (%)	
10-19 years	2 (4.3)	0 (0.0)	2 (4.3)
20-29	9 (19.1)	9 (19.1)	18 (38.2)
30-39	18 (38.2)	0 (0.0)	18 (38.2)
40-49	2 (4.3)	0 (0.0)	2 (4.3)
50-59	2 (4.3)	0 (0.0)	2 (4.3)
60-69	0 (0.0)	5 (10.7)	5 (10.7)
Total	**33 (70.2)**	**14 (29.8)**	**47 (100.0)**

3.2 Predisposing Injuries and Nature of the Wound

Sixteen patients presented with compound fractures sustained from road traffic accidents (RTA), while 30 patients presented with soft tissue injuries (3 patients from RTA; 15 from sharp objects; 4 from burns; 4 from cancer and 4 from bedsores) respectively. One patient had no identifiable injury. Apart from 3 patients who presented with clean, healing wounds; the other patients presented with dirty necrotic soft tissue wounds.

3.3 Portal of Entry

33 (70.2%) patients had injuries located in the lower limbs, 12 (25.5%) patients' injuries were in the upper limbs and the trunk, 1 (2.1%) patient had injuries at multiple sites and the portal of entry could not be identified in 1(2.1%) patient.

3.4 Incubation Period and Time of Onset of Tetanus

The incubation period (IP) (which is the duration between injury and onset of trismus) ranged from 3 days to 30 days, with a median of 7 days. 20 (42.6%) patients had IP of ≥8 days, while 26 patients (55.3%) had IP of ≤ 7 days. The IP could not be determined in one patient. The dot plot of incubation period is shown in Fig. 1.

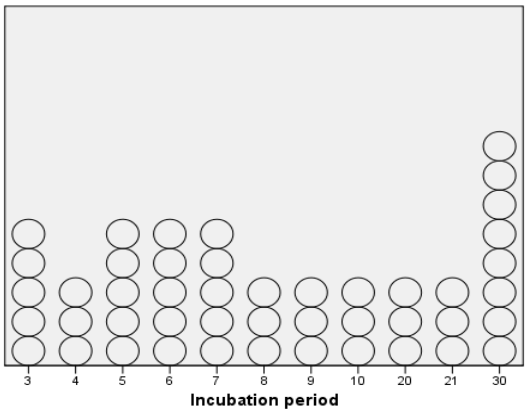

Fig. 1. Dot plot of the incubation period of tetanus patients in ABUTH Zaria

17 (65.4%) of the cases with IP of ≤7 days died, in contrast to 2 (10.0%) patients with IP of ≥8 days (*p=0.008*).

The mean time of onset (OT) of tetanus (which is the duration between onset of trismus and first spasm) ranged from 6 hours to 72 hours, with a median OT of 24 hours. 33(70.2%) patients had an onset time of less than 24 hours, and 14 (29.8%) had onset time of more than 24 hours. All the patients with an onset time greater than 24 hours survived, while 19 (57.6%) patients with onset time less than 24 hours died (*p=0.002*).

3.5 Severity of the Disease

Fourteen (29.8%) cases were mild, 12 (25.5%) were moderate, 16 (34.0%) were severe and 5 (10.6%) were very severe as shown in the Fig. 2. All patients with very severe tetanus died while 14 (87.5%) of patients with severe disease died (*p<0.001)*. 2 (12.5%) patients with severe tetanus and all the cases with mild and moderate tetanus survived (*p<0.001*).

3.6 Complications

All the patients had more than one complication. Multiple response analysis revealed the following complications: aspiration pneumonitis (40%), autonomic dysfunctions (35%), sepsis (25%), orthostatic pneumonia (2%) and urinary tract infection (1%). However, mortality was higher in patients with more than two complications (severe to very severe tetanus) (*p=0.008*).

3.7 Immunization Status

More than 80% (39) of patients were not vaccinated, 11% (5) had primary vaccination with no booster doses while 6% (3%) had full vaccination (i.e. primary vaccination and booster dose in the preceding 5 years). 8 of the patients with positive immunization history were females. There was no significant relationship between immunization status and outcome.

3.8 Outcome of Tetanus

19 patients died with a case fatality rate (CFR) of 40.4%. The factors that were found to predict mortality included: incubation period less than 8 days *(P = 0.08)*; onset time less than 24 hours *(p =0.002);* severity of tetanus *(p < 0.001)* and the presence of complications *(p = 0.008).*

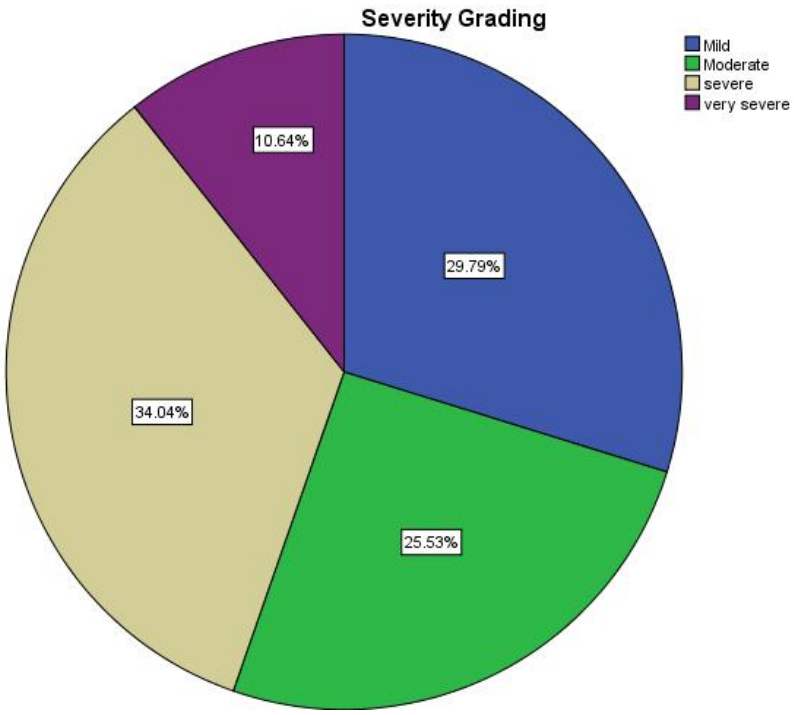

Fig. 2. Severity grading of tetanus patients

4. DISCUSSION

The number of cases of tetanus seen in our hospital per annum, during the period under review, was noted to be less than that reported by workers in other Nigerian and African studies. Similar reviews in other parts of Nigeria reported incidence rates ranging from 3.8/year to 8.6/year of tetanus admissions per center [4,15,16]. The low hospital admission rate for tetanus in Nigeria, particularly for adults, has been attributed to the higher preference for non-orthodox or traditional treatment by patients or their care givers, hinged on the false belief that tetanus is an affliction from 'evil spirits' [23,26,27].

In this study males were affected more than females in the ratio of 2.4:1. The male predominance may reflect the tetanus immunizations status of the patients, as none of the males had received any form of immunization against tetanus. It may also be a confirmation of the role tradition and gender-related factors play in hospital attendance in Northern Nigeria [16]. In Northern Nigeria tradition confines the Muslim females to the home and they do not commonly engage in farming and other manual labours; and so are, therefore, less exposed to injuries than the males [16].

The mean age of patients in this study was 26.50±16.037, which is similar to that reported for tetanus patients in other developing countries where immunization programs are poor [9,10,12,28]. This is in contrast to developed countries where about 70-80% of cases of tetanus are usually seen in elderly patients due to declining immunity [5,13].

More than half (51%) of our patients were students; in contrary to many previous Nigerian studies [16-19]. This pattern of patient population may be a reflection of the fact that Zaria, being host to more than five tertiary educational institutions, has a lot of student population, who are referred to the teaching hospital from their various institutions of learning when they fall ill [22]. This may also reflect the health seeking behavior of this group of patients who, unlike the farmers and other less educated people, were more likely to present to hospital rather than to the alternative medical practitioners. House wives constituted the least affected. This was not unexpected for many reasons. First, they are less likely to be exposed to risk of tetanus as they are confined in the home, and do not engage in manual labours[16]; second, they are more likely to receive immunizations during ante-natal care [10]; and third, women in this part of

the world usually require their husbands' permission before they can come to hospital, and in the event that this was not granted, such women may never present to hospital [16].

Wounds sustained from road traffic accidents (RTAs) were the sources of tetanus in 16 (34%) patients. This finding of RTAs as a common source of tetanus among a significant number of our patients may be an indication of contamination that occurred after the injuries had been tampered with by traditional bone setters and other alternative medicine practitioners. This is supported by the fact that majority of the patients presented with dirty wounds, possibly reflecting the nature of the environment where the injury was sustained or where initial care was rendered before presentation to our hospital. It is common for non-orthodox medical practitioners to apply herbs, cow dung and other concoctions to wounds and fractures, as a form of treatment, without realizing that these materials are the main source of contamination with the *clostridium tetani* spores [1,2].

However, like other studies in West Africa, tetanus frequently resulted from contamination of soft tissue injuries [8,10,28]. These soft tissue injuries occurred in the form of cut, and deep prick or puncture wounds from sharp objects; open wounds from burns and pressure (bed) sores; and malignant tumours. Most of the injuries associated with tetanus in this study were in the lower limbs, and were due to nail or other sharp metal objects, and occurred outdoors. This is similar to the findings of other authors on pattern of clinical presentation of adult tetanus patients [10,17,28,29]. This indicates the need for people involved in high risk jobs to wear boots and other protective clothing. The occurrence of tetanus in patients who were hospitalised for burns, pressure sores and malignancy is a reflection of the lack of evaluation for risk of tetanus by the health care givers, and is an indication of the need for the periodic audit of clinical management of tetanus [29].

The majority of patients who were seen in this study either had no immunization at all, or had incomplete primary immunization for tetanus. None of the patients we saw had a booster dose in the preceding 10 years. This finding is not different from reports on immunization status of adults in many developing countries as many expanded programmes on immunization (EPI) target only children and pregnant women [3,4,7,28]. In Nigeria, the attitude to immunization is generally poor, and history of immunizations is still sparse [10], and the national coverage of immunization to tetanus through the DPT1 and DPT3 (Diphtheria, Pertussis, and Tetanus) vaccines, among infants in 2008 were 47% and 41% respectively [14].

The case fatality rate of 40.4% found in this study compares favourably with case fatality rates of 25% to 75% reported by other workers in West Africa [10,17,28,29]. These findings suggest that tetanus remains a severe disease that affects unvaccinated and inadequately vaccinated adults. Therefore efforts should be directed towards the reduction of the risk of tetanus among our adult population through massive immunization enlightenment programmes, and provision of antitetanus toxoids (primary and booster doses). People at risk of tetanus should be educated to wear protective clothing, and tetanus cases should only be managed by competent health care providers.

5. CONCLUSION

In conclusion, this retrospective study has further highlighted the fact that tetanus remains a significant health challenge in our environment with predominance among teenagers and young and a high mortality rate. The study also revealed that most of the patients were poorly immunized, highlighting the need for strengthening our health care systems in extending vaccination coverage. Short incubation period, short onset time, severity of disease and occurrence of complications were strong predictors of mortality.

CONSENT

All authors declare that 'written informed consent was obtained from the Management of the Hospital Health Information System for publication of this case report and accompanying images.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Abrutyn E. Tetanus. In: Kasper DL, Fauci AS, Longo DL, Braunwald E, Hauser SL, Jameson JL (eds). Harrison's principles of Internal Medicine. 16th edition. Newyork: McGraw-Hill Companies, Inc. 2005;840-842.
2. Bleck TP. Clostridium Tetani. In: Mandell GL, Bennett JE, Dolin R, editors. Principles and Practices of Infectious Diseases. 6th edition. Philadelphia: Churchill Livingstone. 2005;2:2817-2822.
3. World Health Organisation (WHO). Vaccine preventable disease: Maternal and neonatal tetanus (MNT) elimination-the initiative and challenges. Available:http://www.who.int/immunization_monitoring/diseases/MNTE_initiative/en/WHO, Geneva. Accessed on 12 December 2014.
4. Vandelaer J, Birmingham M, Gasse F, Kurian M, Shaw C, et al. Tetanus in developing countries: An update on the Maternal and Neonatal Tetanus Elimination Initiative. Vaccine. 2003; 21(24):3442-3445.
5. World Health Organisation (WHO). The global burden of disease: 2004 update. World Health Organisation; 2008.
6. World Health Organisation (WHO). Tetanus vaccine: WHO position paper. Weekly Epidemiology Records. 2006;81: 198-208.
7. WHO vaccine- preventable diseases monitoring system. Global Summary; 2013.
8. Ogunrin AO, Unuigbe EI, Azubuike CO. Characteristics of tetanus cases seen over a ten year period in a tertiary health facility in Benin City, Nigeria. Ann Biomed Sci. 2006;(1&2):44-51.
9. Patel JC, Mehta BC. Tetanus: Study of 8697 cases. Indian J Med Sci. 1999; 53:393-401.
10. Ogunrin OA, Unuigbe EI. Tetanus: an analysis of the prognosticating factors of cases seen in a tertiary hospital in a developing African country between 1990 and 2000. Trop Doct. 2004;34(4): 240– 241.
11. Current recommendations for treatment of tetanus during humanitarian emergencies. WHO Technical Note; 2010.
12. Kurtzhals JA, Kjeldsen K, Hey AS, Okong'o-Odera EA, Heron I. Immunity to tetanus and diphtheria in rural Africa. Am J Trop Med Hyg. 1997;56(5):576-579.
13. Prospero E, Appignanesi R, D'Errico MM, Carle F. Epidemiology of tetanus in the Marches Region of Italy, 1992-95. Bulletin of the World Health Organisation. 1998; 76(1):47-54.
14. National Population Commission (NPC) [Nigeria]. National Demographic and Health Survey. Abuja, Nigeria; 2013.
15. Osuntokun BO. Perspectives in Tetanus: the past two decades. A symposium on 'Recent Advances in Neuroscience'. Dokita. 1990;19(1):74-78.
16. Habib AG. Tetanus complicating snakebite in northern Nigeria. Acta Tropica. 2003; 85(1):87–91.
17. Arogundade FA, Bello IS, Kuteyi EAA, Akinsola A. Patterns of presentation and mortality in tetanus: A 10-year retrospective review. Nig. Postgrad Med. J. 2004;11(3):198-202.
18. Ojini FI, Danesi MA. Mortality of tetanus at the Lagos University Teaching Hospital, Nigeria. Trop Doct. 2005;35(3):178-181.
19. Onwuekwe IO, Onyedum CC, Nwabueze AC. Experience with tetanus in a tertiary hospital in South East Nigeria. Niger J Med. 2008;17(1):50-52.
20. Chukwubike OA, God'spower AE. A 10-year review of outcome of management of tetanus in adults at a Nigerian tertiary hospital. Ann Afr. Med. 2009;8:168-172.
21. Fawibe AE. The pattern and outcome of Adult tetanus at a suburban tertiary hospital in Nigeria. J. College of Physicians and Surgeons Pakistan. 2010;20(1):68-70.
22. Onalo Richard, Ishiaku Hassan Mshelia; Ogala Williams Nuhu. Prevalence and outcome of neonatal tetanus in Zaria, Northwestern Nigeria. Journal of Infection in Developing Countries. 2011;5(4): 255-259.
23. Omejua EG, Nwosu NI, Onah SK, Chukwurah SN. A 5-year review of tetanus cases among adults in a Tertiary Hospital in South East Nigeria. Afr. Med J. 2011; 2(2):6-11.
24. Ablett JJL. Analysis and main experiences in 82 patients treated in the Leeds Tetanus unit. In Ellis M (Ed). Symposium on tetanus

in Great Britain. Boston Spa, UK. National Reading Library. 1967;1-10.
25. Attygalle D, Karalliedde L. Unforgettable tetanus. European Journal of Anaesthesiology. 1997;14:122-133.
26. Adeuja AOG, Osuntokun BO. Tetanus in the adult Nigerians: A review of 503 patients. E. Afr. Med. J. 1971;48:683-19.
27. Afonja AO, Jaiyeola BO, Tunwashe L. Tetanus in Lagos. A review of 223 adult Nigerian patients. J Trop. Med. Hyg. 1973; (76):171-174.
28. Hesse LEA, Mensah A, Asante DK, Lartey M, Neequaye A. Characteristics of adult tetanus in Accra. West Afr. J Medicine. 2003;22(4):291-294.
29. Hesse LEA, Mensah A, Asante DK, Lartey M, Neequaye A. Adult tetanus in Accra, why the high mortality? An audit of clinical management of tetanus. West Afr. J Medicine. 2005;24(2):157-161.

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