

Incidence of snakebites in Kaltungo, Gombe State and the efficacy of a new highly purified monovalent antivenom in treating Snakebite patients from January 2009 to December 2010*

Incidence des morsures de serpent à Kaltungo, État de Gombé, et efficacité d'un nouvel antivenin monovalent hautement purifié dans le traitement des envenimations entre janvier 2009 et décembre 2010*

F.O. Ademola-Majekodunmi · F.O. Oyediran · S.B. Abubakar

Revised: 29 September 2011, Accepted: 20 March 2012

© Société de pathologie exotique et Springer-Verlag France 2012

Abstract Between 2009 and 2010 there were increasing incidences of snakebites in Kaltungo, Gombe State, Nigeria. Most of the cases presented were treated with the clinically approved drug of choice for snakebite, the Echitab[®] anti-snake venom (ASV) at the Kaltungo Treatment Centre which was manufactured by MicroPharm Ltd, UK and produced in collaboration with the Liverpool School of Hygiene and Tropical Medicine. A total of 5,367 snakebite victims were treated for the two years under review with 82 deaths recorded. This gives a Case Fatality Rate (CFR) of 1.52% compared to CFR of 35-45% before treatment with this ASV. It was also noted that only one dose of this ASV is needed to effectively clear the venom in a victim while other ASVs needed up to six doses or more to clear the venom. This result obtained shows that this antivenom compares favourably with other antivenoms designed for use in Africa with respect to neutralization of the toxins present in the venom of *Echis ocellatus*. Caprylic acid fractionation of horse hyper-

immune plasma is a simple, convenient and cheap protocol for the manufacture of high quality whole IgG antivenoms. It constitutes a potentially valuable technology for the alleviation of the critical shortage of antivenom in Africa.

Keywords Envenomation · Snake · Echitab[®] · Anti-snake venom · Kaltungo · Gombe State · Nigeria · Sub-Saharan Africa

Résumé Entre 2009 et 2010, il a été observé une incidence croissante des morsures de serpent à Kaltungo, État de Gombé au Nigéria. La plupart des cas ont été traités au centre thérapeutique de Kaltungo par un nouvel antivenin monovalent hautement purifié (Echitab[®]), fabriqué par MicroPharm Ltd (Royaume-Uni) en collaboration avec l'École d'hygiène et de médecine tropicale de Liverpool. Au total, 5 367 victimes de morsures de serpent ont été prises en charge au cours des deux années d'étude, avec 82 décès enregistrés. La létalité de 1,52 % doit être comparée à celle de 35-45 % qui était observée avant l'utilisation de cet antivenin. Il a également été observé qu'une seule dose suffisait pour neutraliser le venin chez les patients alors que jusqu'à six doses ou plus des autres antivenins étaient nécessaires auparavant. Ces résultats montrent que ce sérum antivenin donne des résultats très encourageants en comparaison des autres antivenins destinés au traitement des morsures de serpent en Afrique, si l'on considère la neutralisation des toxines présentes dans le venin d'*Echis ocellatus*. Le traitement du plasma de cheval hyper-immunisé est un protocole simple, pratique et bon marché pour la préparation d'antivenins de bonne qualité composés d'IgG entières. Cela constitue une technologie potentiellement utile pour réduire la pénurie critique d'antivenins en Afrique.

F.O. Ademola-Majekodunmi
Former Director Special Projects, Federal Ministry of Health,
Abuja, Nigeria

F.O. Oyediran (✉)
Project Manager,
Control and Management of Snakebites (Echitab),
Federal Ministry of Health, Abuja, Nigeria
e-mail : fatai_oyediran@yahoo.com

S.B. Abubakar
Head,
Kaltungo Snakebite Regional Training & Treatment Centre,
Kaltungo, Gombe State, Nigeria

*Article présenté lors de la 4^e Conférence internationale sur les envenimations par morsures de serpent et piqûres de scorpion en Afrique : Dakar, 25-29 avril 2011

Mots clés Envenimation · Serpent · Antivenin · Echitab[®] · Kaltungo · État de Gombé · Nigéria · Afrique intertropicale

Introduction

Snake bite is a neglected public problem in the rural communities of Africa. Most of the victims are children, peasant farmers, herdsman and hunters. The three most important snakes in Nigeria are *Naja nigricollis*, *Bitis arietans* and *Echis ocellatus* which the latter being the most dangerous snake, causing more death than any other snake on the African continent [2].

Envenoming by snakes is an important public health problem in Africa, where about 500,000 cases occur annually [2], resulting in high mortality and morbidity [2,7,8].

Currently, however, the availability of antivenoms, the only medically approved therapy for treatment, is very limited in Africa; this is due mainly to the major collapse of commercial antivenom production for this continent [3-5,7]. This, together with many other issues related to poor distribution of antivenom, lack of an adequate cold chain and inadequate training of staff in local health centres on how to attend snake bites, has created a critical situation in Africa [3,6]. The solution to this complex problem should include initiatives at the political, educational, scientific and technological levels, promoted both locally and internationally.

Gombe State is situated in the North eastern part of Nigeria, bordering Adamawa, Bauchi, Borno, Taraba and Yobe States. General Hospital Kaltungo, Gombe State is located in the southern part of the state which provided an ideal setting for the EchiTAB[®] Treatment and research centre. Bites by saw-scaled or carpet viper (*Echis ocellatus*) are frequent in the savannah and sub-savannah regions of West Africa where agricultural workers and their children are at greatest risk. Victims of snakebite are taken to the Kaltungo centre which affords us the opportunity of this study using this antsnake venom (ASV) and others for comparative analysis.

Methods

On annual basis, ASVs are being supplied to the various treatment centres and States that requested for it free of charge to treat patients. Records of patients treated at the Kaltungo treatment centre in 2009 and 2010 were kept in the hospital register. Variables that were tracked included the number of treated patients, occupation, sex, and deaths. In order to carry out this study, series of methods were employed, some of which included: Hospital Based Record Review, Data collection, Hospital Morbidity and Mortality surveys and Data analysis.

The Echitab[®] ASV is a new caprylic acid-refined, highly purified whole IgG monovalent antivenom against *Echis ocellatus* venom manufactured by (MicroPharm Ltd, UK).

Results

In 2009, 2669 patients were treated with ASV and 48 deaths (1.8% Case Fatality Rate (CFR)) were recorded while in 2010, 2698 patients were treated with 34 deaths (1.3% CFR). In 2009, 1876 (70.3%) males and 793 (29.7%) females were affected, and 1952 (73.1%) males and 746 (27.9%) females were affected in 2010. A total of 5,367 victims were brought for treatment and 82 died (1.5% CFR) between 2009 and 2010. The results indicated that more males were affected than females, and this trend could be attributed to the fact that more males are involved in farming, fishing, cattle rearing, and schooling in the North-Eastern parts of Nigeria where the survey was conducted while few females are attending schools, therefore, males are more exposed to the danger of snakebites (Fig. 1). Figure 2 indicates that a lot of pupils have been bitten by snakes but majority of those bitten were males because males are more adventurous.

Further results in terms of occupation shows that for the two years under review farmers were mostly affected,

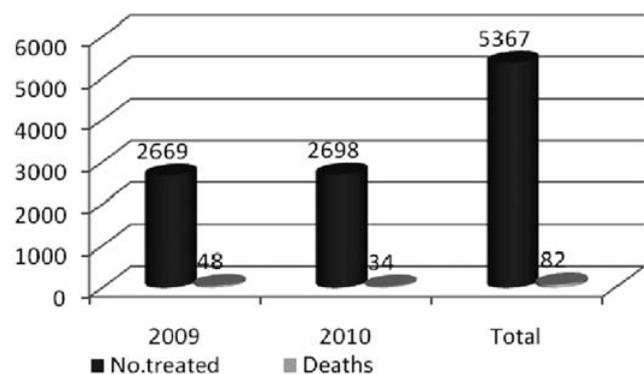


Fig. 1 Trend of patient's treatment and mortality by year 2009 to 2010 / Évolution du nombre de patients traités et de la mortalité annuelle de 2009 à 2010

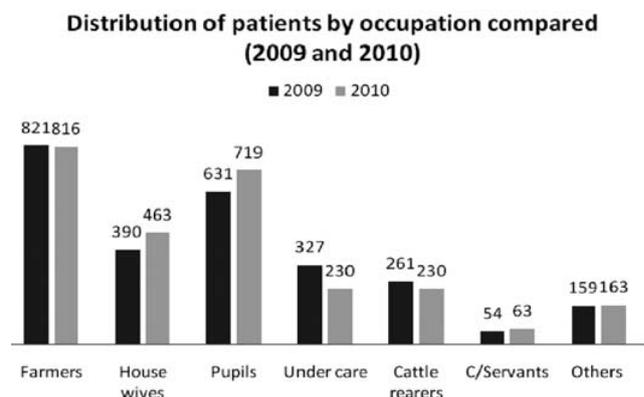


Fig. 2 Distribution of Patients by Occupation, 2009 and 2010 / Répartition des patients par profession (2009 et 2010)

followed by students/pupils, house wives (H/W) and those under care, cattle rearers. Others and civil servants have been the least affected in view of their nature of job for both years. However, more house wives, students, civil servants and others were affected in 2010 compared with 2009 while more farmers, under care and cattle rearers were affected in 2009 compared with 2010 (Fig. 3).

For the two years running, the results indicated that the modal age group is 11-20 yrs, who are mostly youths/students. This is closely followed by the 21-30yr age group consisting of working group, this group and the next 31-40 years impacts negatively on the economy of the area since they are the breadwinners of their respective families. It should also be noted that children aged 0-10 are not left out of this menace. Those in the age groups of 50-60 years and above are least affected probably because they rarely leave home and don't involve in active farming activities.

It could be observed that 99.0% of all those treated with Echitab[®] ASV survived the attacks which is inconsistent with the assertion that the product had a 99.9% cure rate. It is worth noting that most of the mortality recorded was mainly due to the fact that patients were brought late to the centre for treatment, or handled locally with alternative treatment before having been brought to the centre for case management, or due to high degree of envenomation.

A total of 5,367 snakebite victims were treated for the two years under review with 82 deaths recorded. This gives a CFR of 1.5% compared to CFR of 35-45% before treatment with this ASV. It was also noted that only one dose of this ASV is needed to effectively clear the venom in a victim while other ASVs needed up to six doses or more to clear the venom.

Similar study carried out in Goundi Hospital, in Chad Republic between 1997 and 2001 (five years) indicated 325 patients have been admitted and treated with antivenom different from Echitab[®] ASV; the researchers reported a CFR of 8% [1].

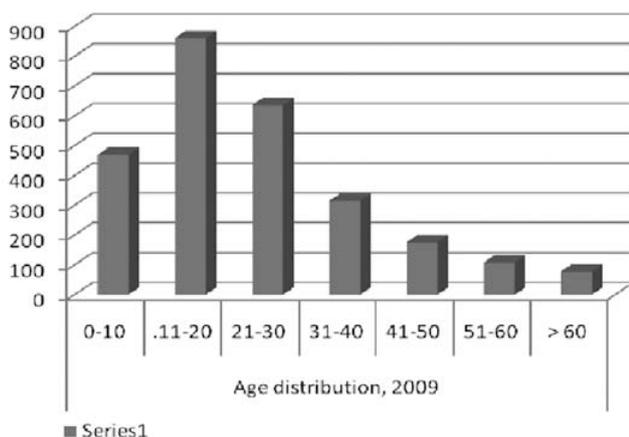


Fig. 3 Distribution of Patients by Age Group in 2009 and 2010 / Répartition des patients par groupe d'âge (2009 et 2010)

In the same vein, we also compared the efficacy of this ASV with that of Bharat Serums, India after both were used in treating an equivalent number of patients. The findings showed that a snakebite victims treated with Bharat ASV required about five or six vials (50-60 mls) to clear venom from bloodstream while if treated with Echitab[®] ASV, the patients only required one or two vials (10-20 mls) to finally clear the venom. Over 200 patients were administered Bharat serum ASV in 2009 and none clotted after treatment; also all came down with anaphylaxis reactions. However, they were all revived using this ASV. This could have resulted to 100% CFR!

Comparatively, a study for five years involved only 325 victims while that of two years involved more than 5,000 victims. The data presented in this study is unique in view of its large number as well as the comparison with another well known product being widely marketed in Africa. It is also noteworthy that all patients (100%) who hitherto were treated with another type of ASV and developed anaphylaxis were all revived after receiving Echitab[®] ASV.

Conclusions

This review to know the current incident rates of snakebite in Kaltungo area of Gombe State is very necessary to guide policy actions and programme intervention. The Echitab[®] ASV has been proven to be effective, safe and potent. It constitutes a potentially valuable technology for the alleviation of the critical shortage of antivenom in Africa. There are no secondary effects or contraindications noted amongst all those treated with this ASV in this study.

This ASV is efficient and of good cost-benefit ratio in view of the fact that the product is specific to Nigerian snakes, because the venom used in producing the ASV were derived from Nigerian snakes. It may therefore be wise to equally state that the product is efficient because we ensured that the cold chain was not broken right from manufacturer to the end users in rural areas where this problem is prominent aside from the fact that the product is of high quality. Consequently, we advise Nigerian government to allocate more funds into Echitab[®] research in order to galvanize the next phase of the agreement leading to process technology transfer, while other African countries prior to that are encouraged to buy ASV from Nigeria to cushion the shortage effect being experienced now.

References

1. Bregani ER, Maraffi T, Tien TV (2011) Snake bites in Moyen Chari district, Chad: a five-year experience. *Trop Doc* 41(2): 123-6. Epub 2011 Feb 8.
2. Chippaux JP (1998) Snake bites: appraisal of the global situation. *Bull World Health Org* 76(5):515-24

3. Chippaux JP (2002) The treatment of snake bites: analysis of requirements and assessment of therapeutic efficacy in tropical Africa. In: Ménez A (ed) Perspectives in molecular toxinology. John Wiley, Sons, Ltd Chichester, 457-72
4. Laing GD, Harrison RA, Theakston RD, et al (2003) Polyspecific snake antivenom may help in antivenom crisis. *BMJ* 326(7386):447
5. Laing GD, Renjifo JM, Ruiz F et al (2003) A new Pan African polyspecific antivenom developed in response to the antivenom crisis in Africa. *Toxicon* 42(1):35-41
6. Theakston RDG, Warrell DA (2000) Crisis in snake antivenom supply for Africa. *Lancet* 356(9247):2104.
7. Theakston RDG, Warrell DA, Griffiths E (2003) Report of a WHO workshop on the standardization and control of antivenoms. *Toxicon* 41(5):541-57
8. Warrell DA, Arnett C (1976) The importance of bites by the saw-scaled or carpet viper (*Echis carinatus*): epidemiological studies in Nigeria and a review of the world literature. *Acta Tropica* 23 (4):307-41