

EDITORIAL

THE NEED FOR AN INTEGRATED APPROACH IN CONFRONTING SNAKEBITE ENVENOMING IN LATIN AMERICA: THE RELEVANCE OF ENDOGENOUS SCIENTIFIC AND TECHNOLOGICAL RESEARCH

HACIA UN ABORDAJE INTEGRAL DEL ENVENENAMIENTO OFÍDICO EN AMÉRICA LATINA: LA IMPORTANCIA DE LA GENERACIÓN DE CONOCIMIENTO CIENTÍFICO-TECNOLÓGICO ENDÓGENO

Snakebite envenomings constitute a serious public health problem on a global level, especially in Africa, Asia and Latin America [1, 2]. In our Latin American region, it is estimated that at least 70,000 snakebite cases occur every year, although the actual number is likely to be higher [3]. This pathology is one of the so-called 'neglected tropical diseases', i.e. a group of diseases that affect primarily poor people in poor settings and, therefore, does not receive the necessary attention from research agencies, pharmaceutical companies, and health authorities. Consequently, it has been described as a 'disease of poverty' [3, 4]. In our continent it largely affects impoverished populations living in rural areas, including indigenous groups [3].

The only way to successfully confront snakebite envenoming in Latin America is through an integrated and holistic strategy encompassing many stakeholders working under an inter-sectorial and inter-programmatic approach, with a philosophy of cooperation. It is necessary, on one hand, to generate a body of scientific knowledge on the problem, including aspects such as epidemiology of snakebites, social, psychological and economic consequences of these accidents, clinical features of envenomings and their treatment, biology of venomous snakes, biochemical and toxicological characterization of snake venoms, and neutralizing ability of antivenoms, among other subjects. These academic tasks should be pursued through interdisciplinary efforts involving natural and social sciences, as well as the humanities, with the participation of groups from different countries.

In addition, it is necessary to undertake programs of technological development and innovation aimed at improving the quality of the antivenoms in the region and to increase the overall volume of antivenom produced. In parallel, efforts should be directed to the improvement of the quality control of antivenoms in the region, with training programs and workshops directed to the regulatory agencies in ministries of health and other institutions. When compared to Africa and Asia, Latin America has a privileged position in the sense that there are antivenom manufacturing laboratories in several countries [6]. Nevertheless, it is necessary to implement renewed efforts in the region to further improve antivenom availability and accessibility, under the coordination of the Pan-American Health Organization (PAHO). It is particularly important to improve the technological platforms and infrastructure, as well as the qualification of technical and professional staff, in a number of antivenom manufacturing laboratories.

There have been many collaborative studies in the region on the analysis of the preclinical efficacy of antivenoms against venoms of medically-relevant Latin American snakes. These studies have demonstrated a high extent of immunological cross-reactivity between antivenoms manufactured in various countries and venoms from different viperid species (see for example Segura et al. [5]). This implies that different antivenoms can be used in various countries for the treatment of snakebite envenomings. This line of

research and cooperation should be further pursued in the region through cooperative initiatives, such as the one previously developed with the support of the program CYTED which involved many research, production and quality control groups of public institutions [6].

Likewise, these regional efforts have to involve a close coordination with national and regional health authorities, including ministries of health, social security systems, and health professionals. It is necessary that health authorities increase their commitment to attend this problem, which usually receives a low priority in health agendas in the region. This commitment should translate in the acquisition and efficient distribution of antivenoms, and the implementation of programs for health staff on the correct diagnosis and treatment of snakebite envenomings; these should be directed to university programs on health sciences as well as to activities targeted to physicians and nurses working in areas of high incidence of snakebites. These programs should take advantage of information and communication technologies and on innovative teaching modalities. A good example is the platform Elluminate, being used by PAHO.

Another area of high relevance has to do with the prevention of snakebites. There are simple interventions at the preventive level that have a high impact at reducing the incidence of these envenomings. These prevention campaigns should incorporate the local community organizations, and should be designed on the basis of the local cultural, ecological, and social contexts, within a philosophy of respect and dialogue with local groups; this is particularly relevant when developing programs in indigenous communities. Prevention programs should also include the development of strategies for rapid transportation of snakebitten people to health centers. The involvement of different types of stakeholders is necessary for successful interventions, including governmental agencies as well as non-governmental organizations of different sorts, and local communal groups.

Within this general frame of action, based on an inter-sectorial and cooperative philosophy, the involvement of research groups in the universities and other research institutions in Latin America is of paramount importance. At the teaching level, the subject of diagnosis and treatment of snakebite envenoming should be formally included in the plans of study of Medicine, Nursing, Microbiology and Pharmacy Schools. In addition, research groups have the responsibility of generating new knowledge on diverse aspects of snakes, their venoms, and snakebite envenomings and their treatment. Latin America has a strong tradition in Herpetology and Toxinology since the pioneer work of Vital Brazil Mineiro da Campanha, the founder of Instituto Butantan in Brazil, early in the XXth century. Thanks to this continental academic tradition, a large body of scientific and technological information has been built on the various aspects of the subject [7]; these efforts should be consolidated. Governmental institutions that support research in Latin America should give a higher weight to this topic in their agendas.

It is necessary to consolidate regional cooperation schemes in scientific and technological research, in such a way that the strengths developed by some groups could benefit other groups in the region, and that emerging research initiatives receive support from more consolidated researchers. Important advances in regional cooperation have been achieved in Latin America; in the case of Colombia, fruitful collaborations have been developed over the years with groups in Costa Rica, Brazil and Mexico. This needs to be further expanded. At the same time, collaborative links should be promoted with research groups from the First World, in order to generate both South-South and South-North cooperation networks. Moreover, public-private partnerships must also be stimulated in the region. An example is the partnership in Colombia between the Program of Ophidism/Scorpionism of the University of Antioquia and an investor for the development of antivenoms against snake venoms from Colombian snakes. This initiative would complement the work performed over several decades by the Instituto Nacional de Salud (INS) in antivenom production.

Research on snakebite envenomings should evolve towards a more interdisciplinary approach and towards the integration of natural and social sciences. The complexity of snakebite envenoming demands such integrated perspective. Moreover, research in this topic has to be 'traslational', i.e. should aim to bring the research results to the actual improvement of the prevention and treatment of snakebite victims. To attain this goal, the university research groups should forge closer links with the clinical sector, the institutions working on the manufacture and quality control of antivenoms, and the social sectors

affected by the problem. This requires that the old-style, unidisciplinary and compartmentalized way of doing research evolves towards more interdisciplinary, comprehensive and translational perspective.

In summary, it is necessary to generate more knowledge in Latin America on the problem of snakebite envenoming, through invigorated scientific and technological research. At the same time, higher levels of synergy and cooperation should exist between research groups, health authorities, health professionals, antivenom manufacture and quality control laboratories, activist groups in the field of public health, the private sector, and local community organizations in regions of high incidence of snakebites. It is only thorough this type of inter-sectorial and cooperative partnership, based on a philosophy of solidarity, that our region will succeed at significantly reducing the impact of human suffering caused by snakebite envenomings.

JOSÉ MARÍA GUTIÉRREZ

Instituto Clodomiro Picado, Facultad de Microbiología, Universidad de Costa Rica.

San José, Costa Rica. Corresponding author: jose.gutierrez@ucr.ac.cr

JAIME ANDRÉS PEREAÑEZ

Programa de Ofidismo/Escorpionismo, Facultad de Ciencias Farmacéuticas y Alimentarias, Universidad de Antioquia. Medellín, Colombia.

REFERENCES

1. Gutiérrez JM, Theakston RD, Warrell DA. Confronting the neglected problem of snake bite envenoming: the need for a global partnership. *PLoS Med.* 2006 Jun; 3(6):e150.
2. Kasturiratne A, Wickremasinghe AR, de Silva N, Gunawardena NK, Pathmeswaran A, Premaratna R, et al. The global burden of snakebite: a literature analysis and modelling based on regional estimates of envenoming and deaths. *PLoS Med.* 2008 Nov 4; 5(11): e218.
3. Gutiérrez JM. Envenenamientos por mordeduras de serpientes en América Latina y el Caribe: Una visión integral de carácter regional. *Boletín de Malaria y Salud Ambiental* 2011 Jun; 51(1): 1-16.
4. Harrison RA, Hargreaves A, Wagstaff SC, Faragher B, Lalloo DG. Snake envenoming: a disease of poverty. *PLoS Negl Trop Dis.* 2009 Dec 22;3(12):e569.
5. Segura A, Castillo MC, Núñez V, Yarlequé A, Gonçalves LR, Villalta M, et al. Preclinical assessment of the neutralizing capacity of antivenoms produced in six Latin American countries against medically-relevant Bothrops snake venoms. *Toxicon.* 2010 Nov; 56(6): 980-989.
6. Gutiérrez JM, Higashi HG, Wen FH, Burnouf T. Strengthening antivenom production in Central and South American public laboratories: report of a workshop. *Toxicon.* 2007 Jan; 49(1): 30-35.
7. Gutiérrez JM. Comprendiendo los venenos de serpientes: 50 años de investigaciones en América Latina. *Revista de Biología Tropical* 2002 Jun; 50(2): 377-394.