Snakebites: reducing their international impact

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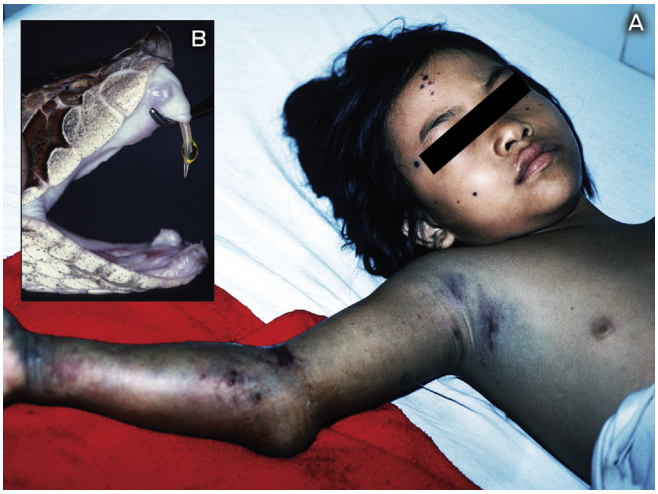
Australian toxinology can contribute more to helping tropical developing countries where snakebites are a serious problem

The venomous fauna of Australia and her surrounding oceans is notorious for its diversity and potential danger.[1] However, thanks to excellent medical services and more than a century of outstanding toxinology research,[2] very few Australians die of snakebite. The eagerly awaited review of the first decade of the Australian Snakebite Project (ASP), published in this issue of the *MJA*, reports on a series of 1548 snakebite patients recruited between 2005 and 2015, of whom only 23 died (case fatality, 1.5%). The report provides much valuable information about how snakebite is currently managed in the clinic.[3]

ASP is an enlightened scheme that collates, orders, and categorises disparate snakebite data from across Australia. Its recruitment of 155 snakebite cases per year is surprisingly low (although the estimate by Sutherland and Tibballs of 3000 cases per year[1] is probably too high). About 500 admissions to Australian hospitals each year have principal ICD-10 diagnoses indicating venomous snakebites,[4] but only 23% of the 750 hospitals that stock antivenom contributed patients to the ASP study.[3] The assertion by the authors that "a very large proportion of the estimated total number of snakebites in Australia" were recruited and their conclusions must be interpreted in light of these reservations. Their promotion of the procrustean antivenom dosage policy of "one vial for all", regardless of clinical severity,[3,5] and their criticism of Australia's unique diagnostic venom detection kit are also contentious. In 2013 they recommended that antivenom treatment be delayed until after a patient had been referred to tertiary care,[5] but they now identify reducing the time to antivenom administration as "an important and achievable goal for improving treatment".[3]

In stark contrast to Australia's low tally of snakebite envenomings and its enviable clinical outcomes, many tropical developing countries struggle to contain this problem, especially in South and South-East Asia (Box), West Africa, the Amazon region, and in Australia's nearest neighbour, the island of New Guinea. Snakebites are responsible for considerable mortality, physical and psychological morbidity, social stigmatisation, and many disability-adjusted life-years (DALYs).[6] In particular, snakebites affect impoverished agricultural workers and their families, and there are many child victims. Accurate quantitation of disease burden is difficult, but recently reliable national mortality data have been provided by well designed community-based surveys in India, Bangladesh and Sri Lanka; it is estimated that there were 46 000 snakebite deaths in India in 2005.[7] In Africa, the high incidences reported for certain areas give tantalising hints of the magnitude of the problem,[8,9] but there is no information for vast areas of the continent, such as the Democratic Republic of the Congo, one of Africa's largest, most populous, and heavily snake-infested countries.

A 9-year-old Vietnamese girl, 17 hours after being bitten on the right elbow by a Malayan pit viper (*Calloselasma rhodostoma*). Two widely spaced fang punctures are visible, with extensive local swelling and bruising and discoid haemorrhages on the face. Inset: Malayan pit viper being milked of its venom



Despite indications of its global importance, snakebite remains ignored and neglected, its investigation unfunded by international agencies. Only recently (June 2017) was it recognised by the World Health Organization as a priority neglected tropical disease, although it causes more deaths than other entities long included in that category.[10] Unlike infections, snakebites cannot be eradicated or prevented by vaccination, but they are eminently controllable with preventive strategies and by improving antivenom treatment.

Successes in preventing snakebite fatalities have been achieved by community education[11] and encouraging farmers to wear boots. Sleeping under a mosquito net prevents the nightmare of domestic krait-bites in South Asia.[12] Motorcycle ambulances expedite referral where there are few roads.[11] Studies in many countries have established recognisable clinical phenotypes of envenoming by different species, providing a basis for syndromic management. Pathophysiological mechanisms of envenoming have been elucidated and the effectiveness of clinical management explored. These advances are embodied in WHO-sponsored clinical management guidelines for African and South-East Asian countries.[13,14] The geographic distributions of medically important snakes and their taxonomic relationships have been established, while the complexities of and geographic variations in venom composition have been clarified by the new technologies of venomics and antivenomics.[15]

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Key aspects of hospital management include treating cardiovascular, respiratory and renal failure, and, above all, using good quality specific antivenom administered by well trained medical staff. These aspects may be taken for granted in Australia, but in the rural tropics the challenges are many. Polyvalent antivenoms should be designed to cover the medically most important species of the region in which they are to be employed. Methods of production, refinement, quality control, and preclinical and clinical testing must accord with accepted standards; further aspects to be considered include economics, supply, distribution, conservation, safety, and post-marketing surveillance.[16]

Australia's accumulated clinical experience and research achievements have an important role to play in helping countries where snakebites are a serious problem. International collaboration is exemplified by the University of Melbourne's links with the Charles Campbell Toxinology Centre in Papua New Guinea; the University of Adelaide's Improving the Health of Snakebite Patients in Burma project (supported by the Department of Foreign Affairs and Trade as an Approved Government Partnership for Development); and the Global Snakebite Initiative, an Australian-registered charity raising the political profile of snakebite and promoting education, research and the implementation of control measures. The strength of Australian toxinology deserves even wider international deployment.

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