Snakebite First-aid Education and its Impact in Rural Madi Valley, Central-South Lowland Nepal

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Financial note: Research grant was provided by America Nepal Medical Foundation, Nepal.

Abstract

Introduction: About 26 districts of the tropical lowland Nepal are at full of risk to snakebite. It was found that no victims followed the first-aid recommended by WHO in this region. Hence, for better dissemination of first-aid, the education program was quite essential. **Methodology:** Madi valley students from Junior Red Cross Circle and well read and write farmers, local healers, health workers and local NGOs representatives were invited for training which was pictorial, visual, participatory, heuristic and conducted in 23-31 Oct. and 19-24 Nov. 2007**.** To lessen the dependency on traditional healing, prominent and famous local healers were invited as guest, encouraged and inspired to participate and ventilate their experiences, activities, faiths on traditional healing of snakebite and other misconceptions on snakes. **Results:** Of the total 165 participants, 88% considered programs the best; 89% developed the ability to apply the recommended first aid. On evaluation after 1 yr., of the total 158 participants, 74% transferred their skill to a total of 2097 locals. But from the systematic sampling (n=360), it was found that 44% locals received the knowledge on snakes and first-aid techniques. Though traditional

healers were convinced with adoption of recommended first-aid and anti-venom therapy initially, but only 40% of them discontinued traditional healing and suggested victims to visit in snakebite treatment centers. Consequently, dependency on traditional healing reduced significantly from 56% to 22% and attracted the people towards recommended first-aid and antivenom therapy. Entire participants initially promised not to kill snakes but impact study depicted that only 62% of total participants left snakes undisturbed and left over killed or attempted to kill them indiscriminately due to fear factor. They were well aware to move victim to snakebite treatment center immediately after the first-aid in comfortable means of transport. On evaluation after 1 yr., 75% of total snakebite victims (n=41) were carried in keeping bicycle, 11% in ambulance, and 6% in bike towards snakebite treatment centers. Because of inaccessibility of ambulance and motorbike, majority of victims used bicycle. The victims arrived at PHC, Basantapur and Bharatpur Hospital (BH), Bharatpur in average of 0.8 hr and 2.2 hrs respectively. A total of 29% were envenomed victims (pit-viper bite 5% + elapid bite 24%); the case fatality rate was 20%. The average ASVS administered to survivals was 56 vials. **Conclusion:** Students focused education programs including susceptible population (e.g. farmers) became significant for dissemination and empowerment of mass people with the invaluable recommended first-aid skill, need of proper transport, and preventive measures for snakebite that reduced the dependency on traditional healing and attracted the people towards invaluable pressure immobilization (PI) and local compression pad immobilization (LCPI) technique. Further, incentive should be provided to traditional healers for referral of snakebite victims visited in their homes to snakebite treatment centers to improve primary snakebite management. The education campaign reduced case fatality rate significantly.

Key words: Snakebite, First-aid, Envenoming, Training, Pressure immobilization, Fatality

Introduction

About 26 districts of the tropical terai and inner terai of Nepal are at full of risk to snakebite. From the research carried out in Bharatpur Hospital in Chitwan, it was found that no victims followed the first-aid recommended by WHO (**Pandey *et al.* 2007**). The majority of deaths in Chitwan and Nawalparasi districts of lowland Nepal could be due to delay in admittance to a treatment center and the dependency of majority (56%) of people on traditional healers for treatment (**Pandey 2007**). The envenomed victims should arrive at hospital comfortably with pressure immobilization (PI) of bitten part with crape bandage and local compression pad immobilization (LCPI) (**Warrel 2005, Sutherland *et al.* 1979, Tun-Pe *et al.* 1995**). A prospective study carried out in Myanmar on efficacy of applying local pressure by compression pads in retarding spread of venom depicted 15 of the 23 (one was incomplete) antigenaemic Russell's Viper bite victims with increased serum venom antigen level (i.e. 10-40 ng/ml) following release of pad. In next 7 locally envenomed antigenaemic victims (with venom level 10-20 ng/ml), the venom antigen disappeared from the circulation while they were undergoing the pad trial. Its efficacy was justified by the retardation of central movement of venom in 13/15 Russell's Viper bite victims. Slightly leakage of venom antigen in 2/15 victims occurred maybe due to mobility of bitten limb (**Tun-Pe *et al.* 1995**). **Howarth *et al.* 1994** suggested that even walking after envenomation leads to systemic envenomation despite first-aid measures. It was evident that even a delay of minutes in application of first-aid may allow absorption of some important venom components. To prevent such capillary venous as well as lymphatic absorption the pressure of the first-aid should be at least 55 mmHg (**Sutherland *et al.* 1981**). Importantly, the pressure above 70 mmHg may even promote absorption possibly due to limb movement because of discomfort from the pressure or because interstitial pressure facilitates capillary

absorption or because lymphatic or capillary permeability is increased by pain-mediated or acidosis-mediated mechanism (**Howarth *et al.* 1994**). These studies alerted that bitten limbs as well as whole body should be immobilized as far as possible to avoid systemic absorption of venom. Hence, in order to better broadcast the invaluable knowledge on appropriate first-aid methods, comfortable and quick means of transport and risk of walking, school and college students, farmers, faith healers, health workers and local NGOs representatives from Madi valley were selected, invited and educated. However, **Currie *et al.* 2008** notified that effectiveness of pressure immobilization first-aid for snakebite requires further study to define the limitation of timing of application, determine the optimum pressure and types of bandage materials used.

The education program endeavored to **train** farmers, students and traditional healers in appropriate first-aid methods, **discourage** dependency on traditional healers, **familiarize** people with venomous snake, and **know the impact** of snakebite first-aid education provided in Madi valley.

Methodology

From each VDCs (Gardi, Bagauda, Kalyanpur, Ayodyapuri) 27 well read and write farmers (if literate farmers were not available, illiterate but leading farmers were selected) from farmers' groups, 5 local healers, 1 paramedic from each health post/health center, 2 representatives from local NGOs, and 40 Junior Red Cross Circle students from 11 educational institutions (1 College, 3 Secondary Schools, 7 Lower Secondary Schools) were invited. Each VDCs (n=4) and school level (n=1) programs were run for 3 days in central places to respective participants from Gardi, Bagauda and Kalyanpur in Buffer Zone Office, Basantapur, Bagauda-3, to participants from

Ayodyapuri in Kharkatta, Ayodyapuri-5, and to students in Red Cross Office, Basantapur during 23 - 31 Oct., 19 - 21 Nov., 22 - 24 Nov. 2007 respectively.

The training was pictorial, visual, participatory and heuristic. **In first day,** in order to **change the attitude on traditional knowledge,** prominent and famous local healers (Gurau, Dhami, Lama, Phukphake) were invited as guest; one of the eldest or the most famous local healer was requested to inaugurate the education program; they were also motivated to participate in entire program, encouraged and inspired to ventilate their past and present activities, faiths on traditional treatment of snakebite and misconception on snakes. Meanwhile, experiences and knowledge on snakes and snakebite treatment of the farmers and students were also noted. Participants were made well aware for identification of venomous snakes by typical characters adopting heuristic teaching, and with the help of demonstration of venomous and non-venomous snake specimens.

Pandey-demonstrating farmers the location and number of **loreal scales**- the identifying features of elapid snakes

Pandey teaching students- **ventral scales** to identify venomous snakes

Pandey teaching students - **hexagonal middorsal scales' line** - the identifying features of Kraits

Pandey demonstrating and enumerating the snake specimens to enable the farmers and students identify venomous snakes

After theoretical and practical classes about snakes, participants were divided in groups for heuristic method of learning and identification of venomous snake found in their localities. Then, participants were also given homework to write any five distinguishing features of venomous snakes.

Students' group discussion for heuristic teaching!

Baghauda farmers pointing position of loreal scale- the distinguishing feature of elapids

Kalyanpur farmers teaching identifying characters of venomous snakes to other groups with the help of rubber snake, cardboards etc.

Students group learning dorsal and ventral body scales (L), prevailed venomous snakes (eg.. Pit-viper) in terai region (R)

In 2nd day, participants were educated with proper first-aid and safety measures to snakebite, and v**alue of quick and comfortable means of transport** to delay the venom dissemination in blood. Class work was given to identify few means of transport that were suitable to their place and shakes body as less as possible. Later, participants were divided in groups for the simulation of snakebite, application of WHO recommended first-aid and proper means of transport at periphery of the venue. Then, participants were provided with evaluation forms to fill it up at venue/ their homes. The participants were discouraged to walking and instructed to exchange with better means of transport like ambulance or motorbike while victims were moved to treatment center in locally available means of transport.

CL Thapa illustrating the prevalent risky multiple tourniquet applied by Nepalese snakebite victims

Thapa and Pandey demonstrating the first-aid methods to elapid snakebite in extremities

Participants in groups were preparing simulation of snakebite, first aid, and transport victim to snakebite treatment center






Participants simulating snakebite, first-aid and transport victim to snakebite treatment center quickly in means of transport that shakes the victim's body less. Meanwhile, spare manpower practiced to call ambulance or motorbike for quick access to treatment centre.

Farmers fulfilling the evaluation form


In 3rd day, behavior of snakes, milking of venom, preparation of anti-venom etc. was learnt to them by displaying film; queries and curiosities of snakes and snakebite treatment were replied; prize was distributed to the best three and two timely arrival participants from each program; certificates were distributed to participants. Then, evaluation of overall program was carried out

by participants through their analytical speech. Finally, participants were made committed providing learnt skill and knowledge to their neighbors, friends, and committee members.

The follow up study of the first-aid education program was carried out during October 2008. Three well instructed interviewer appointed for data collections visited entire participants and 10 locals selected by systematic random sampling of households from each wards (n=10 ind. x 9 wards x 4 VDCs = 360 ind.) and extracted data by the use of pre-tested questionnaires. One of the investigators crosschecked for effective data collection. The records of snakebite during impact study were crosschecked with the data records from Primary Healthcare Center (only one snakebite treatment in Madi valley), Basantapur, and Bharatpur Hospital (only one referral snakebite treatment center for about 4 adjoining districts), Bharatpur, Chitwan.

During impact study, enumerator (Shashidhar Baral) extracting data from participants in education program {farmer (L) and famous traditional healer (gurau) (R)}

Data collection was cross-checked by DP Pandey during field study in households (L) and in Primary Healthcare Center, (R)

Constraints of the Program

- Participants could not be carried to museum of Kasara- the head quarter of Chitwan National Park where they could see many venomous and non-venomous snakes because of financial limitation.
- The simulation of snakebite, application of first aid and methods of transport could not be carried out in Chowk (meeting point of road) due to time constraint. The simulation in chowk could disseminate the skill in mass soon.
- Participants could not understand language of snake-related films as they were in English medium.
- Guests and visitors to program hall denied leaving.

Results and Discussion

i. Participation: Participants were actively involved in education program. A total of 165 individuals were direct beneficiaries (180 were expected), 23 were indirect beneficiaries and 3 were trainers.

Table: 1- Types of Participants and Beneficiaries

A. Direct beneficiaries	**Bagauda**	**Gardi**	**Kalyanpur**	**Ayodyapuri**	**Students**	**Total**	**Expected total**
Local healers	7	4	6	3	-	20	20
Local NGos	1	-	-	2	-	3	8
Health workes	1	-	1	1	-	3	4
Veterinary Paramedic	1	-	-	-	-	1	0
Farmers	25	18	28	30	-	101	108
Students	-	-	-	-	37	37	40
Total	**35**	**22**	**35**	**36**	**37**	**165**	**180**
B. Indirect beneficiaries	**Bagauda**	**Gardi**	**Kalyanpur**	**Ayodyapuri**	**Students**	**Total**	
Guests	4	4	4	4	3	19	
Volunteers	3	3	2	-	1	9 (3)	
Program-manager & announcer	1	1	1	1	1	5 (1)	
Total	**8**	**8**	**7**	**5**	**5**	**23**	
C. Trainer	2	3	3	2	2	12 (3)	
A+B+C	45	33	45	43	44	210	

ii. Prize distribution: Prize was provided to the best three participants and two participants arrived in time from each program for a motivation of learning. Interestingly, announcement of attractive prize to two timely arrivals corrected the delayed arriving tendency for next two days. The education programs became effective because internal

competition developed due to reinforcement with attractive prize caused active and participatory learning.

Table-2: Prize Distribution					
Particulars	Bagauda	Gardi	Kalyanpur	Ayodyapuri	Students
A. Best trainee					
First	Mina Dhakal, Bagauda-8	Khem Bd. Sunuwar Gardi-4	Dina Nath Paudel Kayanpur-4	Ghanshyam Paudel Ayodyapuri-1	Rama Aryal Harinagar L. Sec. S.
Second	Praba Datta Neupane, Bagauda-8	Hiramani Mahato Gardi-5	Ganga Adhikari Kalyanpur-3	Radha Devi Ayodyapuri-2	Urmila Bashyal Madi Campus
Third	Nem Narayan Yadab, Bagauda-5	Ganga Dhakal Gardi-3	Jaya Ram Chaudhari Kalyanpur-1	Bhabu Ram Adhikari (small) Ayodyapuri-2	Shiva Raj Timilsena Madi Campus
B. Trainee in time					
First	Churamani Pandey, Bagauda-4	Jian Mahato (Gurau) Gardi-5	Rishi Ram Adhikari Kalyanpur-7	Gita Gautam Ayodyapuri-5	Uma Bhandari Krisnanagar L. Sec. Sc.
Second	Mohani Lal Aryal, Bagauda-7	Bishnu Maya Mahato Gardi-5	Sabita Subedi Kalyanpur-7	Yuba Raj Adhikari Ayodyapuri-9	Santosh B.K. Krisnanagar L. Sc. S.
Total	5	5	5	5	5

iii. Attitudes of Local Healers: Eventually, local healers promised to adopt the first-aid recommended by WHO because they clarified with their unscientific and illogical misconceptions and traditional practice. On evaluation after one year, only 40% traditional healer discontinued to traditional healing of snakebite and started to suggest victims visited in their home to visit in Primary Healthcare Center, Basantapur, or in Bharatpur Hospital. Left over, traditional healers interested to continue healing as a duty to serve locals.

iv. Evaluation of the program: A total of 88% participants replied for program was the best, 7% for better and 5% for good. The facts behind their choices for the best were:

1. empowered the needy people (farmers and students) of rural community with invaluable knowledge of first-aid to snakebite that would save life and reduce the mortality and morbidity if they reached the treatment center in time in appropriate means of transport,
2. got new and unique information on snakes, and became able to distinguish the venomous snakes from non-venomous, knew their importance and diversity in Nepal,
3. got idea how to prevent from snakebite and defects of traditional treatment of snakebite.

v. First-aid skill transmission: Of a total of 165 participants, 89% developed the ability to apply recommended first-aid; rest trainee demanded additional training programs to enable them to transmit knowledge to locals. On evaluation after 1 year, of the total 158 participants (7 were absent) 74% transferred their skill to a total of 2097 locals including students. But from the systematic sampling (n=360), it was found that 44% locals received the knowledge on snakes and first-aid techniques from those who participated in education programs and rest knew nothing about it. However, it was found that the education programs disseminated the first-aid methods in mass effectively.

Of the total snakebite victims (n=41) recorded after training and till date of impact study, only 56% adopted recommended first aid, 22% adopted traditional treatment (use of tourniquet, visit to faith healers, suction of wound, use of snakestone etc.) and 22% adopted nothing prior to access in to treatment center. One faith healer (gurau) treated himself for snakebite and did not visit treatment center because of his confidence over his treatment. From the study in Western Bengal, India, it was noted that about 80% envenomed victims visited Ozas (traditional healers) prior to arrival in treatment center (Saha and Hati 1983). Present study depicted that the education programs reduced the dependency on traditional healing from 56% from (Pandey 2007) to 22% and attracted the people towards invaluable PI and LCPI te

chniques of first-aid.

vi. Attitudes on Snakes: Initially, all participants **promised not to kill snakes** wherever they encounter or see because they were convinced with their medicinal, economical and ecological values. On evaluation after 1 yr., of the total 158 participants, 62% would leave them undisturbed, 26% would kill them if they entered home, 10% trainee would kill snake immediately after encounter or see them, and the rest would call help to kill them. They killed snakes indiscriminately due to fear factor.

vii. Means of transport and Time of arrival in Snakebite Treatment Centers: Participants became well aware to move victims to snakebite treatment center immediately after the application of appropriate first-aid keeping in comfortable and quick means of transport that shakes the bitten parts/ whole body as less as possible without delay. Evaluating on transport, following orderly listed transport methods were considered to applicable to rural people:

1. Keeping victim in back of supporter (if event were in river bank, jungle etc.)
2. Keeping victim in Doli- a structure made from blanket, bed sheet etc. (if event was aside home)
3. Keeping in coot (Khatia or Charpai) {Doko- a structure made up of bamboo for hill region}
4. Keeping in Stretchure
5. Keeping in Cycle (but not allowed victim to ride)
6. Keeping in Motorbike
7. Keeping in Ambulence

Though they selected cart, they were alerted not to use **cart** that delays and shakes the body more because of difficulties to avoid joltings. Ambulance and Motorbike were less frequently available means of transport in Madi valley. On evaluation after 1 yr., of the total snakebite victims (n=41), 75% were carried in keeping cycle, 11% in ambulance, and 6% in bike in snakebite treatment centers. One victim accessed treatment center on walking, next two victims walked for a while to access to bike and ambulance respectively. From the study it was found that majority of people were compelled to use cycle instead of ambulance and motorbike due to inaccessibility of comfortable vehicle to them.

The victims arrived at PHC, Basantapur and Bharatpur Hospital (BH), Bharatpur in average of 0.8 hr and 2.2 hrs respectively.

viii. Epidemiology of snakebite in Madi valley: Of the total snakebite victims (n=41) recorded during Sept 2007- Oct 2008, 51% were male, 29% were envenomed victims (pitviper bite 5% + elapid bite 24%). Of the total elapid bite, 2 died i.e. case fatality rate was 20% (one on the way to BH and next during medication in BH). The education program reduced the case fatality rate from 27% (Pandey 2007) to 20%. The average ASVS administered to survivals was 56 vials which exceeded the record of 40.6 vials by Pandey *et al.* 2007, and 32 vials by Pandey 2006.

Conclusion

Education program can be made effective by reinforcement (eg. providing prize) method. Students focused education programs became significant for dissemination of first-aid and transport methods in mass effectively as they learnt skill quickly and transmitted it efficiently. Concurrently, the susceptible population (e.g. farmers) should be empowered with appropriate first-aid and transport methods and preventive measures of snakebite to minimize the

dependency on traditional healing and to increase the attraction towards PI, LCPI, and antivenom therapy that will reduce the untoward mortality rate. Further, incentive should be provided to traditional healers by treatment center or concerned agencies for referral of snakebite victims visited in their homes to treatment centers so that dependency on traditional healing would be nullified and victim would access the treatment center in time. Appropriate first-aid education campaigns are needed in Terai valley of Nepal so that the effectiveness of first aid can be assessed with quantitative blood venom level before and after release first-aid, timing and duration of first-aid application, types and size of bandage materials used and pressure generated and maintained over time for different sized limbs in near future. The information on snake, snakebite, symptoms, treatment, superstitions, first aid and transport methods should be disseminated through such programs in nooks and corner of snakebite prone areas, radio, FM, television channels, books/booklets, CDs (visuals), poster or calendar illustrating major venomous snakes. Also, antivenom should be distributed to each and every health post of snake prone area and provide optimum training to those health professionals working respective health posts.

Acknowledgement

We are grateful to America Nepal Medical Foundation (ANMF) for grant without which the education programs in Madi valley could not be accomplished successfully. Moreover, we are indebted to Dr. Saroj Dhital, Dr. Shankar Rai and Ngwang C. Lama of ANMF, Nepal branch and Dr. Fred Shephardson- the project manager ANMF USA branch for their generous assistances.

Also, we do like to appreciate Ass. Prof. Dr. Ranjana Gupta, Ashok Bam, Satish Kumar Jha, of Parasitological Research and Socio-Environmental Development (PARASED), Nepal for their continual openhanded support to accomplish the education programs.

We are thankful to R.C. Piya from Association for Nature Conservation and Social Upliftment (ANCSU), Nepal, Dept of Zoology, Birendra M. Campus, Tribhuvan University, Bharatpur, Chitwan for his assistantship in education programs, to Kedar Baral- the Chairperson of Maheshori Farmers Coalition for invitation to farmers in education programs, and to Nava Prasad Pandey for his managerial role, to Shahidhar Baral, Mamata Pandey and Anup Bhusal – the volunteers from ANCSU, Nepal for their tireless support devotedly and wholeheartedly to accomplish the education programs.

At last we would like to thank to Shashidhar Baral- principal, Khairahani Secondary School, Baghauda-7 (also ANCSU member), Mukti Neupane- principal, National Primary School, Jiwanpur, Ayodyapuri, and Bishnu Acharya, Student, Birendra M. Campus, Tribhuvan University, Bharatpur (resident of Kalyanpur-5, Kirtanpur) for data collection during the impact study of the education program and to those who directly and indirectly supported the education program and impact study.

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