

One-Day National Seminar



DR. RASHBEHARI SINHA
1ST ANNUAL MEMORIAL
LECTURE ON

**“Snakebite and its Management –
The Indian Scenario”**

Honourable Speaker

Dr. Kaushik Bharati

Ph.D., MIPHA, FRSPH (London)



Team Lead, COVID-19 Research Trackers-UNESCO
New Delhi

Organized by

Department of Physiology
Berhampore Girls' College
Berhampore, Murshidabad, W.B. 742101

Venue : Conference Hall

Date : 02/03/2023

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প্রাক কথন

বহরমপুর গার্লস কলেজে ফিজিওলজি বা শারীরবিদ্যা বিভাগের পথ চলা শুরু হয়েছিল অধ্যাপক ড. রাসবিহারী সিন্হা মহাশয়ের হাত ধরে ১৯৮১ সালে। প্রথমে তিনি ছিলেন আংশিক সময়ের অধ্যাপক। ঠিক এক বছর পর ১৯৮২ সালের ৬ জানুয়ারি তিনি পূর্ণ সময়ের অধ্যাপকরূপে যোগদান করেন। পরবর্তীকালে ১৯৮৫ সালের ২ ডিসেম্বর যোগদান করেন অধ্যাপক ড. বিদ্যুৎ বিকাশ দালাল মহাশয়। দু-জনের ঐকান্তিক চেষ্টায় ১৯৯৫ সালে পথচলা শুরু হয় ফিজিওলজি স্নাতক সাম্মানিক বিভাগটির। ড. সিন্হা বিভাগের পরিকাঠামোর উন্নতির জন্য বিশেষ করে পরীক্ষাগারে নতুন যন্ত্রপাতি কেনার জন্য শুরু থেকেই খুব সচেষ্ট ছিলেন। ২০০২ সালে তিনি কান্দি রাজ কলেজের অধ্যক্ষ হিসেবে যোগদান করেন এবং সেখান থেকেই অবসর গ্রহণ করেন। এই সদা হাস্যময় সুপুরুষ আমাদের সবাইকে ছেড়ে না ফেরার দেশে চলে যান ২০২১ সালের অক্টোবর মাসের ৮ তারিখে।

শারীরবিদ্যা বিভাগ ড. সিন্হার অবদানকে স্মরণে রাখার উদ্দেশ্যে প্রতিবছর তাঁর নামে স্মরণীয় বক্তৃতার আয়োজন করবে বলে স্থির করেছে। প্রথম বছর বক্তব্য রাখবেন বিশিষ্ট বিজ্ঞানী ড. কৌশিক ভারতী মহাশয়। ধন্যবাদ জানাই কলেজের অধ্যক্ষ মহাশয়া সহ আমার সহকর্মীদের এবং কৌশিক ভারতী মহাশয়কে।

ধন্যবাদ সহ,

বহরমপুর,

তাং-০২-০৩-২০২৩

স্মৃতিরতন ত্রিপাঠী

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ড. রাসবিহারী সিন্হা স্মরণে

বহরমপুর গার্লস কলেজের শারীরবিদ্যা বিভাগের প্রতিষ্ঠাতা-অধ্যাপক ড. রাসবিহারী সিন্হা কে প্রথম চিনেছিলাম একজন পরীক্ষক হিসেবে। মালদা এস.এস.সি অফিসে পাশাপাশি টেবিলে বসে খাতা দেখছি। মুখ তুলে হাসি বিনিময়, পরিচয় প্রকাশ। জেনে ভালো লাগল যে জেলার বিখ্যাত কলেজ বহরমপুর গার্লস কলেজের শারীরবিদ্যা বিভাগের অধ্যাপক - যে কলেজের প্রতি আমারও ছিল অন্তরের শ্রদ্ধা ও অন্যরকম ভালোলাগার অনুভূতি। ওনার বিষয়ের খাতা অল্প। দু-দিনেই খাতা শেষ। কিন্তু আমার বাংলার খাতা অনেক থাকায় দীর্ঘমেয়াদী পরিকল্পনা। আমার সঙ্গে ওনার খাতা দেখার শেষে বেশ গল্প জমিয়ে ফেললেন। আবারো পরে দেখা হলে গল্প করবেন জানালেন।

তার পরের বছরও আবার দেখা একই কাজে অফিসে। এবার তাঁর পরিচয়টা গেল বদলে, অধ্যক্ষ, কান্দি রাজ কলেজ। আমিও কান্দিবাসী, গল্প আরও জমে উঠল। তারপর মাঝে মাঝেই ফোনালাপ চলতো। খুব অমায়িক ব্যবহার। তারপর বহরমপুর গার্লস কলেজে এসে তাঁর ব্যবস্থাপনায় প্রতিষ্ঠিত ও শ্রীবৃদ্ধি সাধিত বিভাগের কথা বিস্তারিত জেনে তাঁর প্রতি শ্রদ্ধা আরও বেড়ে গেল। তাঁর যোগ্য সহধর্মিনী অধ্যক্ষ শ্রীলতা চৌধুরীর সঙ্গে পরিচিত হয়ে পুরো পরিবারটির সম্পর্কে একটা সুস্পষ্ট ছবি তৈরি হয়ে গেল। সুশিক্ষা-স্ব-শিক্ষায় গড়ে ওঠা পরিবারটির সমস্ত ভারসাম্য ভেঙে দিয়ে

রাসবিহারী বাবু ২০২১ খিস্টাব্দের ৮ অক্টোবর চলে গেলেন না ফেরার দেশে। থেকে গেল তাঁর স্নেহে গড়ে তোলা বহরমপুর গার্লস কলেজের শারীরবিদ্যা বিভাগ ও তাঁর সৃষ্ট কর্ম।

বিভাগের বর্তমান অধ্যাপকবৃন্দ স্থপতির প্রতি শ্রদ্ধা জানাতে ও স্মরণে রাখতে বিশেষ বক্তৃতার আয়োজন করেছেন। তাঁদের এই শুভ প্রচেষ্টাকে সাধুবাদ জানাই। ধন্যবাদ ও কৃতজ্ঞতা জানাই প্রথম বছরের বক্তা বিজ্ঞানী ড. কৌশিক ভারতী মহাশয়কে। অনুষ্ঠানের সর্বাঙ্গীন সাফল্য কামনা করি।

হেনা সিন্হা

অধ্যক্ষ

বহরমপুর গার্লস কলেজ

ড. রাসবিহারী সিন্হা : আমি যেমন দেখেছি

পাপিয়া ব্যানার্জী

সহযোগী অধ্যাপক

বাংলা বিভাগ, বহরমপুর গার্লস কলেজ

“হায়রে হৃদয়,

তোমার সঞ্চয়

দিনান্তে নিশান্তে শুধু পথপ্রান্তে ফেলে যেতে হয়

নাই নাই, নাই যে সময়।”

এই তো জীবন। আমরা সবাই ক’দিনের জন্যে একত্রে মিলিত হই, আবার যখন জীবনের ভাঁড়ার পূর্ণ হয়, সব ফেলে রেখে চলে যেতে হয়। পিছন থেকে আর ফিরে ডাকা যায় না। তবু কোনো কোনো মানুষ নিজ গুণে মনের মধ্যে জায়গা করে নেয়। এমনই একজন মানুষ ড. রাসবিহারী সিন্হা, আমাদের রাসবিহারী দা। উনি ছিলেন ফিজিওলজির অধ্যাপক। না, এই বিষয়ে তাঁর কতটা পাণ্ডিত্য ছিল, তিনি কেমন শিক্ষক ছিলেন তা বিশ্লেষণ করার ক্ষমতা আমার নেই। ঐ বিষয়টি একেবারেই আমার অধিগত নয়। আমি দু-চারটি কথা বলার চেষ্টা করবো আমার দেখা একজন নিপাট ভালোমানুষ রাসবিহারী দা’কে নিয়ে।

১৯৯৩ এ যখন এই খ্যাতনামা কলেজে যোগদান করি, তখন ওনাকে

পেয়েছিলাম বড়ো দাদা হিসেবে। রাগ করে থাকতে পারতেন না। মুখের হাসি কখনো মিলিয়ে যেতে দেখিনি। একটা কথা মনে পড়ছে উনি কাজের মানুষ হওয়া সত্ত্বেও কিন্তু ফাইনাল পরীক্ষার ডিউটি দিতে বেশ নিরুৎসাহী ছিলেন। একবার একটা ঘরে আমাদের দুজনের ডিউটি ছিল, সেদিন ঘর থেকে বেরোতে পারেন নি। হয়তো আমি নতুন, আমাকে একা রেখে যেতে হবে বলে, খুব বিরসভাবে কাজটি সম্পন্ন করেছিলেন। মনে হয় ওনার মতো প্রাণখোলা মানুষের পক্ষে ঐ পুলিশী কাজটি করা কষ্টকর ছিলো। কিন্তু অন্যদিকে কলেজের বিভিন্ন দায়িত্ব সুচারুরূপে সম্পন্ন করার ক্ষেত্রে কোনোদিন কোনো ত্রুটি বা অনীহা চোখে পড়ে নি।

অসাধারণ সৌজন্যবোধ ছিল রাসবিহারী দার। এখানে লিখতে গিয়ে রাসবিহারী দা লিখছি, কিন্তু আমাদের সম্বোধনের ভাষা ছিল ‘রাসবিহারীবাবু’। আসলে তখন এই বহরমপুর গার্লস কলেজে ওটাই সংস্কৃতি ছিলো। বড়ো দাদাদের ‘বাবু’ বলা, আর সেই দাদারাও আমাদের নামের সঙ্গে ‘দিদি’ জুড়ে দিতেন (যা আমরা পরবর্তীতে পরিবর্তন করে ফেলেছি)। কিন্তু রাসবিহারী দা সম্বোধন করতেন ‘দিদিমণি’ বলে। বেশ মিষ্টি লাগতো ডাকটা। এই ছোট ছোট বিষয়গুলোই ওনাকে অনন্যতা দিয়েছিলো। দেখা হলেই বলতেন ‘বলুন দিদিমণি কী খবর’ - গলার স্বরটা এখনো কানে ভাসে।

সালটা ২০০০, সময়টা ডিসেম্বরের বার্ষিক ক্রীড়া প্রতিযোগিতা। কলেজে অধ্যক্ষ’র দায়িত্ব নিয়ে এলেন ড. শ্রীলতা চৌধুরী। তাঁর আর একটি পরিচয় তিনি অধ্যাপক ড. রাসবিহারী সিন্হার স্ত্রী। এই সময়ে রাসবিহারী দার

আরো এক দিকের সঙ্গে পরিচয় ঘটলো আমাদের। তিনি, অধ্যাপিকা মঞ্জুলা বণিক আর এই প্রতিবেদককে সেই মুহূর্তে অনুরোধ করলেন আমরা যেন তাঁর স্ত্রীর দিকে একটু খেয়াল রাখি। আর আমরা এক অন্যরূপে রাসবিহারী দাঁকে পেলাম, যিনি যত্নশীল স্বামী। অধ্যক্ষ ড. শ্রীলতা চৌধুরী কলেজে যোগদানের পর থেকে যে দু-বছর রাসবিহারী দা এই কলেজে ছিলেন, আমার চোখে মাঝে মাঝেই তাঁর এই রূপটি স্পষ্ট হয়ে উঠেছে। তিনি বিশিষ্ট অধ্যাপক অবশ্যই, কিন্তু তাঁর অধ্যাপক সত্তা তাঁর পারিবারিক সত্তাকে আচ্ছন্ন করতে পারেনি।

সদা হাস্যময় মানুষটা ছিলেন আদ্যন্ত নিরহংকার; অথচ অহংকার করার মতো অনেক কিছুই ওনার ছিল। বিদুষী প্রতিভাময়ী স্ত্রী আর তিনটি কন্যারত্ন। রাসবিহারীদার কন্যারা প্রকৃত অর্থেই রত্নতুল্য। কিন্তু এই ডাক্তার, ইঞ্জিনিয়ার কন্যাদের নিয়ে কখনো কোনোরকম গর্বের উক্তি করতে শুনিনি। বিপরীতে এ সম্পর্কে বলতে গেলে শুধু স্মিত হাস্যোজ্জ্বল মুখটিই চোখে পড়েছে। আজকের দিনে এমনটা সত্যি শিক্ষণীয়। এই বিজ্ঞাপনের যুগে যখন সব কিছুই প্রকটভাবে বিজ্ঞাপিত, তখন এই স্মিত নীরবতার সামনে মাথা নত করতে হয়।

২০০২ সালে তিনি বহরমপুর গার্লস্ কলেজের কুড়ি বছরের অধ্যাপনার জগৎ থেকে বিদায় নিয়ে কান্দি রাজ কলেজে অধ্যক্ষ হিসাবে যোগ দেন। ঐ কলেজ থেকেই তিনি অবসর গ্রহণ করেন। আর ২০২১ সালের অক্টোবর মাসের ৮ তারিখে তিনি সবাইকে ছেড়ে চলে গেছেন না ফেরার

জগতে। হাস্যোজ্জ্বল মানুষটা আজ আর আমাদের মধ্যে নেই। আমরা জানি “মৃতেরা এ পৃথিবীতে ফেরে না কখনো।” তবু তাঁরা হারিয়ে যান না। থেকে যান “....অঘ্রাণের পথে পায়চারিকরা শান্ত মানুষের / হৃদয়ের পথে।” কাউকে চিরদিন ধরে রাখার ক্ষমতা আমাদের নেই। তবু কাছের মানুষেরা অক্ষয় হয়ে থাকেন স্মৃতিতে। যে স্মৃতি ‘বড়ো বেদনার মতো’ জেগে থাকে প্রাণের গভীরে।

Tribute to Dr. Rashbehari Sinha
Keya Ghatak
Associate Professor in English
Berhampore Girls' College

The successful life of Dr. Rashbehari Sinha reminds us the famous words of P.J.Bailey, “He most lives Who thinks most, feels the noblest, acts the best.” It is his great deeds, great thoughts and great feelings in a short earthly existence, that have made him famous and glorious in the history of Physiology Department of Berhampore Girls’ College. He has also cast an inspiring stamp in the history of Academic journey of Berhampore Girls’ College as the founder of Physiology Department. As a gentleman, he cherished no malice and expressed no meanness. He was free from every sort of bias or prejudice. He never entertained any biased view or indulged in any malicious criticism. He did not behave himself by despising and ridiculing others. He kept his conscience pure and clear from jealousy, hate, or contempt. He avoided carefully whatever might cause a jar or a jolt in the minds of those with whom he was associated. He ever remained calm and restrained his temper in a provocative situation. He had a broad mind and a liberal outlook. He knew it very well how to tackle the adverse situation.

Born and brought up at Andul village, he was graduated from City College. He had obtained Post-graduate Degree from the University of Calcutta. He had added two more feathers to his Academic cap to complete Ph.D. from the University of Calcutta and B. Ed. from Union Christian Training College. His Academic qualifications helped him to go forward step by step in the journey of his service life. Before joining Berhampore Girls’ College as an Assistant Professor, he worked as Assistant Teacher in Lalbagh Singhi High School and as a Part -Time Teacher in Krishnath College. After joining Berhampore Girls’ College, he had taken special Training in Mysore for enriching the Department of Sericulture as the in Charge of that Department. His special Training for Computer had enhanced the Department of Computer to a great extent. He had decorated the chair of Principal of Kandi Raj College before his retirement. His vast experience had helped him to adorn the chair of Principal of Prabharani B.Ed. College for a long time. As a Bursar of Berhampore Girls’ College, he had performed his duty very well. He was always ready to help the teachers as per their need. Once upon a time, he had also helped me as a Bursar at the time cutting of the Blackberry tree of New Hostel of Berhampore Girls’ College. The tree was weak on account

of being attacked by storm. At that time he had convinced Principal to give order to cut the branches of that tree. He was an ideal teacher who, by his knowledge, character, and day-to-day life, left the profoundest influence on the intellectual and moral characters of his students. He was successful to perform his duty as teacher. As a teacher, he not only instructed his students but also inspired them. He bore a very high character and was much respected by every one of our college. He was the member of the Governing Body of Berhampore Girls' College for a term. He was honoured by both friends and foes for his intelligence, courage, and many other human qualities. He was possessed of regular habits, did his work in the proper time. He was always conscious of the value of time and regularity. He followed a strict routine in his life. He distributed his time and energy aptly to develop service journey of his wife and academic journey of his daughters. He had performed his duty as husband and father very successfully. He inspired his wife to complete her Ph. D. degree. His wife became the Principal of Berhampore Girls' College after the completion of her Ph.D. When her wife used to go to Kolkata for her Ph.D., all the time her husband accompanied her to reach station at the time of arrival at the station and departure from the station just

like a very sincere and dutiful husband. He had helped his three daughters at the time of bringing them up. He was not unnecessarily in hurry. He carried out his work steadily and perfectly. He was never erratic or careless in his duties. He never repented or was enraged by the loss of time. His way of living was always smooth and clear. His role as a father was praiseworthy. His sincerity made him live a clean, disciplined and healthy life. It assisted him to find out the right course of action. He was always accessible to young and inexperienced mind.

He knew that knowledge was the sure and only cure for the great ills of life. His desire to initiate works for the welfare of students was the way along which he could find scope for such work. He knew to use the great blessings of discipline in every sphere of life. In his class, in his chamber and in his home, he maintained discipline very successfully. His unfailing adherence to discipline was the best staff to cross the stiff hurdles of life. His torch of knowledge tore the darkness of ignorance, superstition and hatred among the students. His purpose in life was to inspire confidence in his students, command their respect and win their co-operation. He built the character of his students and shaped the destiny of his students. He rendered a very noble service to society with

the help of his proper knowledge and his remarkable administrative power. He had offered many chairs for the teachers of Berhampore Girls' College. The great effort of our Dr. Smritiratan Tripathy to immortalize the work and name of Dr. Rashbehari Sinha among the students and teachers, is really praiseworthy. Actually he becomes immortal to establish the Physiology Department of Berhampore Girls' College.

Biosketch **Dr. Kaushik Bharati**

Dr. Kaushik Bharati is Team Lead, COVID-19 Research Trackers at UNESCO, New Delhi and a former Consultant for WHO, Geneva, Switzerland. He obtained his PhD in Physiology with specialization in Vaccinology from the University of Calcutta in 2001. He carried out his doctoral work at the Calcutta School of Tropical Medicine. He did his Post-doctoral Fellowship from the Liverpool School of Tropical Medicine, UK, specializing in Immunology and Molecular Biology. He was formerly a Scientist at the National Institute of Immunology (NII), New Delhi and a Senior Program Officer at the Translational Health Science and Technology Institute (THSTI), NCR Delhi. He was also a Visiting Professor in the Departments of Physiology and Microbiology at Vidyasagar University, Midnapore. Besides academics, he also has a rich consultancy experience. Besides WHO, he has also worked for Global Health Strategies, New York, USA; Sanofi Pasteur, Lyon, France; Policy Cures, Sydney, Australia; the Science Advisory Board, Arlington, Virginia, USA; and the Initiative against Diarrheal and Enteric diseases in Asia (IDEA),

Lyon, France. His major research areas include Virology, Vaccinology, and Public Health. He has published over 90 papers in reputed national and international journals and has also co-authored a book entitled “Basic Concepts in Immunology”. He has delivered numerous invited lectures at national and international conferences. He is currently on the Editorial Board of 18 journals from India, UK, USA, Canada and UAE. He is on the Peer-review Panel of 15 medical journals from India, UK, USA, China, Indonesia, and Nigeria. He is also a PhD Examiner of the University of Calcutta and Lincoln University College, Malaysia. He is a member of 37 organizations across the globe. Notably, he is a Fellow of the Royal Society for Public Health (London). He has received 15 awards for his research work from India, New Zealand, UK, and USA.

Snakebite and its Management – The Indian Scenario

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ABSTRACT

India has a wide variety of snakes, both venomous and non-venomous, distributed across a wide variety of terrains. They come in various shapes and sizes and have spectacular colorations on their surface. Of all the Indian snakes, several are highly venomous and are responsible for countless snakebite incidents, resulting in at least 50,000 deaths annually, which is a gross underestimate as many deaths go unreported. Hence, snakebite is a serious public health problem in India, but surprisingly, has a low priority in the Indian health system, compared to other diseases like malaria, TB, and HIV/AIDS. Snakebite is managed initially through

First Aid, followed by definitive treatment by administration of snake antivenom. Indian snake antivenom is polyvalent in nature, as it is made from a cocktail of venoms from the four medically important snakes – the so-called Big Four – namely, cobra, Russell’s viper, common krait, and saw-scaled viper. Timely treatment with antivenom could potentially save thousands of lives. The lecture will highlight these key areas and will suggest remedial measures for tackling the snake-bite menace in the Indian context.

Snakes have fascinated man since time immemorial. They have ignited the imagination of people across the globe, from diverse backgrounds, races, ethnicities, and religions. Their mention can be found in various texts since the earliest times of recorded history. They have been a reason for awe and fear in the minds of mankind, which has led to snake worship in various cultures, as early as the Egyptian civilization, over 5,000 years ago. Even to this day, snakes are worshiped in various parts of India. Snakes have inspired many legends and have been the topic of many mythological tales.

Since lay people do not know much about snakes, they are misunderstood and feared. In India, the majority of the snakes are harmless, except for four species that account for thousands of deaths annually. Snakes can be as small as just a few centimetres, but can grow up to 10 meters in length. Snakes can live in a wide variety of habitats, which range from scorching hot deserts, humid tropical forests, freezing Himalayan climes, and even the deepest oceans. Moreover, snakes have a variety of fascinating skin colourations, which are possibly rivalled only by the ornate and colourful wings of butterflies. However, the graceful movements and sheer elegance of snakes remain unparalleled in nature.

Historical records indicate that as far back as 326 BC, when Alexander the Great invaded India, he was very impressed by the adeptness of the Indian physicians in treating snakebite patients. Since then, India has been known for its notoriety for venomous snakes and the mortality and morbidity caused by their bites.

Indian Venomous Snakes

There are over 270 species of snakes in India, of which 60 are venomous. Some of these are abundant and can cause very severe envenoming.

Classification of Venomous Snakes

On the basis of fang type and venom type, venomous snakes are classified as *Solenoglypha* (retractable fangs and hemotoxic venom) and *Proteroglypha* (fixed fangs and neurotoxic venom). Venomous snakes are classified into the following five families:

- ***Viperidae***: This family includes the “*True Vipers*”. They have thick bodies and heads that are much wider than their necks. They come in many different sizes, markings and colours. They have long, hollow, moveable fangs that perform like hypodermic syringes. Their venom is highly hemotoxic that attacks the blood cells. The most common example is Russell’s viper.
- ***Elapidae***: This family includes the cobras and kraits. These elapids have highly neurotoxic venom that attacks the nervous system, causing respiratory paralysis and their fangs are fixed and immovable.
- ***Crotalidae***: This family includes the so-called “*Pit Vipers*” because they have a heat sensitive pit located between the eye and nostril on either side of the head. Examples of crotalids include the bamboo pit viper,

Himalayan pit viper and hump-nosed pit viper.

- ***Colubridae***: This family has the largest number of snakes in the world. These are known as the “*Back-fanged*” snakes because their fangs are pointed backwards and are mostly harmless to man. The most common example is the boomslang, which is present in sub-Saharan Africa.
- ***Hydrophidae***: As the name suggests, this family includes all the sea snakes, which have a variety of colours and shapes. These snakes have highly neurotoxic venom that is more toxic than cobra venom. Examples include the black and yellow sea snake, hook-nosed sea snake, and yellow-lipped sea krait.

Medically Important Venomous Snakes

There are four medically important snakes in India, which account for the highest mortality. These include the Indian cobra or spectacled/biocellate cobra (*Naja naja*), Russell’s viper (*Daboia russelii russelii*), common krait (*Bungarus caeruleus*), and saw-scaled viper (*Echis carinatus*). These are briefly discussed below:

- ***Indian Cobra***: These are also called spectacled or biocellate cobra (*Naja naja*), since they have a distinctive “spectacle-like” marking on their hood. This is one of

India's most common snakes and is distributed across India, except the north-eastern states, Jammu & Kashmir, Uttarakhand, and Himachal Pradesh. It is approximately 2.2 m in length, fast and alert, and is active both by day and night. It is also a very good swimmer. It eats rodents, toads, frogs, and birds. Another common type of cobra is the monocled or monocellate cobra (*Naja kaouthia*).

● **Russell's Viper:** This viper, scientifically known as *Daboia russelii russelii*, is named after Dr. Patrick Russell, who discovered it in 1796 along the Coromandel Coast in South India. It is distributed pan India, except in Jammu & Kashmir. Its venom is highly hemotoxic. It is approximately 1.8 m in length. The snake is usually nocturnal in habit, usually slow but strikes very fast and hunts by ambush. When disturbed, it hisses loudly and bites only as a last resort. It feeds on rodents.

● **Common Krait:** Scientifically known as *Bungarus caeruleus*, this snake has the most potent venom of all Indian land snakes. It is distributed across India, except in Arunachal Pradesh, Uttarakhand, Himachal Pradesh,

and Jammu & Kashmir. The venom is highly neurotoxic and is 15-times more toxic than cobra venom. It kills by respiratory paralysis. It is approximately 1.7 m long and is nocturnal in habit. It feeds on rodents, lizards, and frogs.

● **Saw-scaled Viper:** This is also known as carpet viper (*Echis carinatus*). It is distributed across India, except in Jammu & Kashmir, West Bengal and the North-East. It is extremely dangerous because it comes in frequent contact with humans, causing the highest number of snakebite deaths in India. Its venom is highly hemotoxic. Its average length is 80 cm, mainly nocturnal in habit and moves by fast side-winding motion. It eats mice, lizards, frogs, scorpions, and insects.

King Cobra – Truly the King of All Snakes!

The King Cobra (*Ophiophagus hannah*) is the longest venomous snake in the world and can grow up to a staggering 19 feet! It is distributed in northern India, bordering Nepal as well as in eastern India, including West Bengal, Odisha, Bihar, Chhattisgarh, and Jharkhand. It is also present in all the states of the North-East. Besides these states, King Cobras are particularly plentiful in the dense jungles along the Western Ghats.

King Cobra is extremely fast, highly alert, and very aggressive. It is possibly the only snake that has some degree of intelligence. It is capable of injecting up to 7 ml of highly neurotoxic venom in a single bite, which kills by attacking the nervous system. This amount of venom is so toxic that it is capable of killing up to 20 adult humans or even an adult elephant! Death occurs within 10 minutes. Moreover, since there is no antivenom for King Cobra, death is inevitable. However, the good news is that it rarely comes in contact with humans, since it lives primarily in dense jungles. Hence, fatalities from King Cobra are rare. One peculiar feature of this snake that should be noted is that it eats other snakes. That's why it's called "*Ophiophagus*" which in Greek, means "*snake-eater*".

Venomous Sea Snakes

There are two important venomous sea snakes along the Indian coastline and in the Indian Ocean.

- ***Hook-nosed Sea Snake:*** This is scientifically known as *Enhydrina schistosa* and is the most common Indian sea snake. It is found along the entire coastline of India, as well as in the waters surrounding the Andaman & Nicobar Islands. It can grow up to 5.2 feet in length. Its

venom is 4-10 times more toxic than cobra venom. Fishermen are particularly at risk of being bitten by this snake. This snake primarily feeds on fish.

- ***Yellow-lipped Sea Krait:*** This is also called banded sea snake and is scientifically known as *Laticauda colubrina*. It is found throughout the Indian Ocean. It can grow up to 4.9 feet in length. It is nocturnal in habit and its victims are usually fishermen. It feeds on eels and other fish.

Non-venomous Snakes

There are approximately 31 categories of non-venomous snakes in India, which includes hundreds of species. Of these, six major species are briefly highlighted below:

- ***Indian Rat Snake:*** As the name suggests, these snakes are rat-eaters, although they are also known to eat mice, frogs, toads, birds and lizards. Rat snakes, scientifically known as *Ptyas mucosa*, are the most common and familiar snakes in India. They are large (up to 11.5 feet in length; males larger than females), fast terrestrial snakes that are active by day and are good climbers. They are excitable and likely to bite if picked-up, but become docile when handled gently.

- **Common Vine Snake:** As the name suggests, these snakes are bright green in colour and look like vines. Scientifically known as *Ahaetulla nasuta*, these are medium-sized to large (up to 6.6 feet in length; females larger than males) and slow, slender, diurnal snakes with pointed snouts. Vine snakes have eyes with horizontally elliptical pupils and binocular vision. They will bite if handled. They eat lizards, frogs, mice and small birds.
- **Checkered Keelback:** Scientifically known as *Xenochrophis picastor*, these snakes are so called because they have a checkered pattern and a distinct keel (fold) on their back. They are common, small to medium-sized, nocturnal/diurnal snakes and mostly found in or around ponds. They eat fish, frogs, rodents, and birds.
- **Indian Rock Python:** Scientifically known as *Python molurus molurus*, they are very large (up to 25 feet in length; females larger than males), slow, and mainly nocturnal snakes, which climb and swim well. They are constrictors (kill by constriction by wrapping around the prey) and feed mostly on mammals and birds, sometimes reptiles and amphibians.

- **Ornate Flying Snake:** Scientifically known as *Chrysopelea ornata*, they are medium-sized (up to 5.7 feet in length), slender, active, diurnal tree snakes that do not actually fly, but glide through the air. They are excellent climbers. Like pythons, they are also constrictors that feed on geckos, rodents, bats, and birds.
- **Red Sand Boa:** Scientifically known as *Eryx johnii* they are sometimes nicknamed “Two-headed Snake” because their head and tail look alike. They are slow, stocky, medium-sized (3.3 feet in length; females larger than males) burrowers which are nocturnal and live on sandy soil. They are distant relatives of the boa constrictors of South America. That’s why they’re powerful constrictors and feed on amphibians, reptiles, rodents, and birds.

Snake Venom

Snake venom is the poisonous fluid stored in the venom glands, which are actually modified salivary glands, located at the back of the head. Secretion of Snake Venom: The venom is secreted through the venom canal and fangs into the snake’s prey. Fangs are of two types, namely fixed and

retractable. The fixed fangs do not move and are typically present in elapids such as cobras and kraits. The retractable fangs are capable of moving back-and-forth and are present in the vipers such as the Russell's viper and saw-scaled viper.

Composition of Snake Venom: Snake venom is composed of a complex cocktail of toxins, and it is this complexity that is responsible for the widely differing effects of snakebites. The snake venom toxins are primarily of two types: the hemotoxins that attack the blood and the neurotoxins that attack the nervous system. The former are present in the vipers, while the latter are present in the elapids. Other toxins include cardiotoxins that are toxic to the heart, and cytotoxins, which are toxic to cells. The toxins are predominantly (~90%) made-up of proteins and peptides. Some of these exhibit specific effects on various biological functions, such as blood clotting, conduction of nerve impulses, and blood pressure regulation, amongst others. Snake venom is rich in enzymes, especially hydrolytic enzymes. Enzymes in snake venom make-up approximately 80-90% of viper venom and 25-70% of elapid venom. These include phospholipase, phosphodiesterase, L-amino acid oxidase, protease, peptidase, metalloprotease, and nuclease,

to name a few. These enzymes in snake venom help to immobilize and digest the prey and also provide defence against threats.

Medical Uses of Snake Venom: Venom is used for producing antivenom that is used for treating snake envenomation. Some medicines have also been derived from snake venom. For example, hemotoxins have been used to produce drugs for treating high blood pressure, heart attack, and blood disorders. Neurotoxins have been used to develop drugs for treating brain disorders and stroke. The first venom-based drug to be developed is Captopril, derived from the Brazilian pit viper and used for treating high blood pressure. Other drugs developed from snake venom include Etifibatide from rattle snake and *Tirofiban* from African saw-scaled viper, which are used for treating heart attack and chest pain.

The Snakebite Problem in India

Snakebite is a very serious medical problem in India. It is estimated that the total number of annual snakebite deaths globally is approximately 100,000, whereas the total number of snakebite deaths in India is 50,000 annually. Therefore, India alone contributes approximately 50% of the global

snakebite deaths! These figures clearly show the magnitude of the snakebite problem in India. Moreover, these statistics could be a gross underestimate as these data are based primarily on hospital records and most snakebite deaths go unreported, especially in remote rural areas. The situation is further aggravated by traditional snakebite healers called “Ojhas” who are incompetent in treating venomous snakebite, thereby appreciably increasing the death toll. In India, snakebite deaths predominantly occur in rural areas (97%), are more common in males (59%) than females (41%), and peaks during the monsoon months of June to September. The age group of 15 to 29 years’ experience the highest burden of snakebite deaths. The states with the highest burden of snakebite deaths include Uttar Pradesh (8,700), followed by Andhra Pradesh (5,200) and Bihar (4,500).

Signs and Symptoms of Venomous Snakebite

The signs and symptoms of envenoming depend on the type of venom injected, which are primarily hemotoxic or neurotoxic in nature.

Major Symptoms of Viper Bites: The major symptoms caused by the bites of Russell’s viper and saw-scaled viper

are associated with hemorrhage and bleeding, as all vipers have hemotoxic venom. Some of the major symptoms include bleeding gums, hemorrhage in the GI tract, hematemesis (*blood in vomit*), hemoptysis (*blood in sputum*), epistaxis (*bleeding nose*), hematuria (*blood in urine*), melena (*blood in stool*), coagulopathy (*clotting abnormalities*), hypotension (*low blood pressure*), ecchymosis (*bruising*), and swelling. In case of Russell’s viper, specific symptoms include extensive blister formation and necrosis. Saw-scaled viper bites are characterized by bleeding from the bite site and rapid discolouration at the bite site. Major Symptoms of Cobra and Krait Bites: Since these snakes have neurotoxic venoms, the symptoms are related to neurotoxicity. Some of the common symptoms include ptosis (*drooping eyelids*), sluggish pupillary response, diplopia (*double vision*), dilated pupils, difficulty swallowing, difficulty breathing, difficulty speaking, arrhythmia (*irregular heartbeats*), hypotension, respiratory paralysis, cardiac arrest, intense desire to sleep, glossopharyngeal palsy, loss of consciousness, and coma.

Management of Snakebite

Management of snakebite involves both psychological and medical approaches.

Psychological Management: This is very important, as many snakebite deaths can occur due to fear or anxiety. The patient must be reassured. Panicking must be avoided at all costs, as this can compromise judgement, thereby increasing the chances of making mistakes while attending to the patient. It should be noted that excessive panicking on the part of the patient can prove to be fatal, even from non-venomous snakebites.

Medical Management: This involves administering treatment in the form of field-based “*First Aid*” and hospital-based definitive treatment by “Antivenom Therapy”.

First Aid

First Aid should be short, simple and quick. Not much time should be wasted on it. First Aid involves reassuring the patient, immobilizing the bitten limb, and arranging for transportation.

The currently recommended First Aid is based on the mnemonic “*Do it R.I.G.H.T.*”, which involves the following:

R = Reassure the patient, due to the following reasons:

- Approximately 65-70% of total snakebite cases are due to non-venomous snakes.
- Only 50% of venomous snakebites actually cause envenomation.
- Approximately 85-90% of venomous bites do not develop any signs and symptoms of envenoming.

I = Immobilize the limb as for a fracture.

- Use cloth to hold the splints in place.
- Don’t apply too much pressure, as this can block the blood supply.
- Don’t apply any compression in the form of tight ligatures, as these are ineffective and can be dangerous.

G.H. = Get to the **Hospital** immediately.

- Don’t waste time in visiting traditional healers such as “Ojhas”.
- Traditional remedies have no proven benefit against venomous snakebites.

T = Tell the doctor about any systemic symptoms that may have been observed.

The Do's and Don't's

It is very important that certain things should be done, while others should not be done. These so-called do's and don't's are briefly highlighted below:

Do's

- Reassure the patient that death is rare as most bites are non-venomous and that medical care is available.
- Remain calm and control anxiety. Make the patient feel relaxed. Excitement can elevate blood pressure and increase blood circulation, which will spread the venom much faster throughout the body.
- Lay the patient flat on the back and keep the bitten limb below the level of the heart.
- Remove shoes, watches, tight clothing, rings, bracelets and amulets as these can cause obstruction in case of swelling.
- Be ready to carry out cardiopulmonary resuscitation (CPR) on the patient.

Don't's

- Don't apply a tourniquet as the blood supply to the bitten limb will be cut-off. This can cause necrosis and even

gangrene, which may require amputation.

- Don't apply any chemical solution such as potassium permanganate on the bite site.
- Don't cut the bitten area to extract the venom as viper bites can cause uncontrollable bleeding due to non-clotting blood, as a result of which the patient may bleed to death.
- Don't use electric shock therapy as it doesn't work and is very dangerous.
- Don't freeze or apply extreme cold on the bite site.
- Don't apply any herbal or folk remedies, including snake stones on the bitten area as there is no scientific proof of their efficacy.
- Don't attempt to suck-out venom with your mouth, since the venom could spread into your body in case you have a mouth ulcer. Moreover, the fangs of snakes are highly colonized with pathogenic bacteria, as a result of which the bite site is also infected. Therefore, infection can spread if you attempt to suck out the venom with your mouth that could even result in sepsis.
- Don't use any suction devices to remove the venom as these don't work and could cause harm to the patient.

- Don't give the patient any alcoholic drinks or drugs. Only water can be given in moderation and paracetamol can be given for relieving pain.
- Don't try to capture, handle or kill the incriminating snake to bring to hospital for identification. Instead, take a photo with your mobile camera if the snake is still in the vicinity.
- Don't waste time going to traditional healers, Ojhas, or quacks as they are incapable of treating venomous snakebites. They only appear to succeed as most bites are non-venomous. Only antivenom therapy is life-saving in case of venomous snakebites.

Antivenom Therapy

Antivenom therapy is the only scientifically proven treatment for venomous snakebites. This is discussed below:

Discovery of Antivenom: Snake antivenom was discovered by Dr. Albert Calmette, a French physician, bacteriologist, and immunologist who was attached to the Pasteur Institute in Paris. Calmette, who was a close associate of Louis Pasteur, developed snake antivenom in 1894, while at the Pasteur Institute.

He demonstrated that it is possible to “hyperimmunize” an

animal with increasing doses of venom. A second envenomated animal can be saved by the serum of the immunized animal. This antivenom was popularly known as Calmette's serum. Calmette immunized horses to produce the antivenom. This discovery is still the basis for the production of modern antivenoms.

Antivenom Production: The first step in the production of snake antivenom is extraction of the venom from snakes. The head of the snake is held firmly and the fangs are anchored to the corner of a Petri dish and the venom glands are gently squeezed to “milk” the snake. The venom collects within the Petri dish. The venom is dried and then solutions are made at graded concentrations in double distilled water or saline. Next, horses are immunized with increasing doses of the venom over a span of 1-2 months. This stimulates the immune system to produce antibodies against the venom. After completion of the immunization course, the horses are bled from the jugular vein in the neck. The blood is allowed to clot and the serum is separated. The antibodies in the serum are purified, which are the active components of the antivenom.

The antivenom is available in both liquid and lyophilized (freeze-dried) forms. The liquid form is less stable and requires a cold-chain for storage and has a 2-year shelf-life. The lyophilized antivenom is available as a powder and is more stable. It requires only to be kept cool while in storage and has a 5-year shelf-life.

Antivenom may be monovalent (raised against a single species of snake) or polyvalent. Indian antivenom is polyvalent, meaning that venoms from several species of snakes are immunized to raise the antivenom. In India, the venom from the “Big Four”, namely, Russell’s viper, Indian cobra, common krait, and saw-scaled viper are used for producing the antivenom. Therefore, Indian antivenom is effective against all of the above four medically important snakes.

Antivenom Treatment: Antivenom is very expensive and in short-supply. Therefore, it should be administered only when envenomation is confirmed. The antivenom dose may vary with the degree of envenomation i.e., mild or severe envenomation. Each vial contains 10 ml of antivenom. Generally, 8-10 vials of antivenom are required for treating

an envenomated patient. However, higher doses (20 vials or more) may be required in very severe cases. It is to be noted that children should receive the same dose of antivenom as adults.

Since antivenom is raised in horses, the antibodies are foreign to the human body. This can lead to adverse serum reactions. Anaphylaxis is a life-threatening condition that can occur due to antivenom reactions. In this situation, the antivenom must be stopped immediately and epinephrine (adrenaline) should be administered to control the anaphylaxis.

Antivenom Manufacturers in India

In India, polyvalent snake antivenom is available against the “*Big Four*”. Currently, there are seven snake antivenom manufacturers in India, which are listed below:

- Haffkine Bio-Pharmaceutical Corporation Ltd., Mumbai
- Bharat Serums and Vaccines Ltd., Mumbai
- Serum Institute of India Ltd., Pune
- Bengal Chemicals and Pharmaceuticals Ltd., Kolkata
- Central Research Institute (Govt. of India), Kasauli

- Biological E. Ltd., Hyderabad
- VINS Bioproducts Ltd., Hyderabad

Prevention of Snakebites

Prevention is always better than cure as per the old proverb, which says “An ounce of prevention is worth a pound of cure”. Therefore, it is recommended to take some preventive measures to avoid snakebites, which include the following:

- Avoid places where snakes may live. Snakes can hide inside heaps of leaves, firewood, as well as piles of coal or cow dung cakes used for cooking purposes in rural areas.
- While walking at night, always wear heavy boots and long trousers. Use a torch to see the path in front of you. Tread heavily, as this will create vibrations on the ground, which can be detected by snakes and they will move away.
- Use a stick to poke the ground in front of you while walking on rough terrain. This will scare away any snakes.
- Avoid sleeping on the floor, especially in rural areas, as there is a chance of being bitten by kraits, which enter homes in search of food at night.

- Avoid bathing in ponds, streams and rivers after dusk as this can increase chances of being bitten by venomous snakes such as cobras, which can be mistaken for non-venomous checkered keelbacks due to the low visibility. It should be noted that cobras, like checkered keelbacks, are good swimmers.
- Never handle a snake, even if it’s dead. It can still bite by reflex action!

Conclusion

Snakebite burden in India remains the highest in the world, yet it is still grossly underestimated and underreported. Since the largest proportion of global snakebites is contributed by India, global snakebite estimates, could also be underestimated. There is an urgent need for proper community education, awareness programs, appropriate training of medical personnel, and better availability and distribution of antivenom, especially in the 13 states with the highest prevalence of snakebites. This could significantly reduce snakebite deaths in India.