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Variation of Heart Rate in Patients with Snake Bite

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ABSTRACT

The HRV is the Physiological variation of Beat-to- Beat variation in heartbeat. This variation is controlled to on balance by the autonomic nervous system (sympathetic and parasympathetic). Snake bite is the most common problem in tropical and subtropical countries. Snake bite is related to highest mortality of poorly developed countries mainly the farmers suffered a lot. As per the World Health Organization's list the snake bite is neglected tropical diseases. Immediately after the snake bite toxicity of the venom enters into circulation and affects various parts of the body. The snake venom acts on the Autonomic nervous system, and affect the heart and reduces the heart rate. The HRV is a clinical and investigational tool for assessing the cardiac performance. Analysis of Heart Rate variability is one of the non-invasive electrocardiographic markers to find out the changes HRV in snake bite patients. In snake bite envenomation the increases HRV (P-Value is <0.05) is considered as the statistically significant. We conclude that autonomic control of the heart rate measured by heart rate variability was altered on acute action of snake envenomation. Initially there was parasympathetic dominance in snake bite and treatment with antivenom lead to sympathetic dominance.

Keywords: Heart rate variability, low frequency, high frequency, envenomation.

INTRODUCTION

According to world health organization snake bite is neglected tropical disease, which accounts to thousands of deaths occurs annually. India has the highest number of deaths due to snake bites in the world where thousand people die per year [1]. Venomous snakes are found in arid, tropical, subtropical and temperate region except Antarctic region. Sheltering place of snake are Garden, Valley, paddy field, wood, house hold kitchen, poultry farms etc. Farmers suffers lots of snake bite, especially the males suffer a lot of snake bite. During rainy monsoon seasons huge numbers of breeding of snake occur at simultaneously get more people exposed to snake envenomation[2]. Poisonous snakes are found in India are Cobra, Krait and Viper[3]. Snake venom contains complex mixture of organic compounds [4]. Many of these compounds produces a variety of path physiological effects including local tissue damage and or systemic in the affected indivual[5]. The toxins of the venom act on the autonomic nervous system which affect the heart rate and also the venom of cardio toxin directly act on the cardiac muscle to reduce the force of contraction and reduce the heart rate. HRV is a noninvasive electrocardiographic marker which reflects the activity of the sympathetic and vigil components of ANS on the sinus node of the heart[6]. Heart rate Variability (HRV) is the variation in the time interval between heart beats i.e., RR interval variability which expresses the total amount of both instantaneous HR and RR interval. HRV analyses are the tonic baseline autonomic function. In normal heart rate there will be continuous physiological variations of sinus cycle

reflecting the sympathovagal balance[7]. Intravenously administered antivenom neutralises the venom by causing it to be released from receptors. Thus the receptors sites are free to interact with neurotransmitters. Antibodies bind to the venom and chemically change it so it cannot interact with the receptors[8]. Snake venom contains a toxins which have enterotoxin which acts presynaptically to increase release of acetylcholine probably by binding to neuronal voltage gated Na^+ channel and increases the reduce of acetylcholine. It also acts by blocking K^+ channels and thus prolonging action potential.[9] The snake venom modifies the electro physiological properties of the cardiac cell membrane and can have a profound effect on impulse generation and conduction throughout the heart [10]. The venom reduces resting membrane potential, amplitude, duration of action potential and contractility and also venom act on autonomic nervous system which alter the heart rate[11].

MATERIALS AND METHODS

This observational prospective study was conducted in the department of physiology, with the approval of Institutional ethical committee and after obtaining the Informed consent from subject/ care taker available at the time of admission, the study was initiated

Inclusion Criteria

A total of 30 cases of neurotoxic snake bite envenomation cases of only male who were brought to the hospital for admission. Envenomation of the patients were confirmed by History and clinical examination and bleeding time, clotting time.

Exclusion Criteria

Subjects with Hypertension, Diabetes, cardiac illness like congestive heart failure, Atrio- ventricular arrhythmia, Heart block, Ischemic heart diseases, female cases of snake bite envenomation and patients on drugs with the history of cardiovascular illness were excluded from the study. Immediately after admission, i.e. before administration of anti-venom. Heart Rate Variability recording (5minutes) was done. HRV was recorded by using Medicaid PR 937 Polygraph by the following steps. ECG Recording is done by connecting electrodes from the patient to the polygraph which is connected to the Analog to Digital convertor (AD-Converter) which is in turn connected to the personal computer. Recording of Heart rate variability is done in personal computer which was first edited, after deleting the artifacts analysed by AIIMS software which was installed in the personal computer- by relevant parameters of Frequency domain such as LF (nu), HF (nu), and LF/HF ratio were analyzed. Specific characteristics of the power spectrum of the HRV can be used to quantify sympathetic and parasympathetic control on the heart. The two frequency bands were considered that low frequency and high frequency. The low frequency was considered as marker of both sympathetic and parasympathetic activity and the high frequency was considered solely with cardiac parasympathetic activity [12, 13]. The ratio of LF/HF was chosen as sympathovagal balance.

RESULTS

At the time of admission heart rate decreases i.e., after 8 hours of admission and after the administration of antivenom, shows there were statistically significant increase in heart rate. In HRV, the heart rate was lowered at the time of snake bite. After the treatment of antivenom the heart rate comes to normal level and is maintained. Sympathetic activity shows decrease at the time of admission and increases after the administration of antivenom, within 24 hours and becomes normal and within 48 hours. We obtain an increase in parasympathetic dominance immediately after admission and after administration of antivenom we obtain a decrease of parasympathetic activity. The disturbed Sympathovagal balance at the time of

admission is normalize and due to treatment, and for a period maintained in 48 hours.

Table 1: ***Comparison of (5min) of HRV parameters before and after treatment in snake bite***

Milli Sec	Adm(5mts)	Antivenom treatment (5mts)	24Hrs (upto 6 hourly) (5mts)	48Hrs (upto 6 hourly) (5mts)
HR	63.00±12.56	80.3±10.08*	78.80±10.32*	76.44±8.08
LF	49.37±24.017	64.7 ±18.38	58.52±14.70*	54.80±13.98
HF	54.76±16.75	44.5 ±20.46*	46.94±14.23*	42.64±16.0*
LF/HF	1.02±.77	1.02±1.36*	1.31±.241	1.32±.26

Values of mean ± SD at snake bite envenomation.
**(P<0.05) Signifies HRV in before and after treatment in snake bite*

DISCUSSION

A through literature survey indicates that there is an increased heart rate after snake envenomation and also, they quote there is a parasympathetic dominance after 8 hours of snake bite envenomation[14]. Envenomation plays a vital role in myocardial damage and toxicity effects on myocardium causes alteration in heart rate variation[15]. In addition, toxin is the main factor for electrocardiographic changes. Apart from it elevated cardiac enzymes are the associated closely for cardiac arrhythmias. The results of the present study demonstrate that heart rate variability, an indicator of the activity of the autonomic nervous system on heart rate gets altered on exposure to snake bite envenomation. Snake venom have different types of toxins and of these, cardiotoxins are one group of toxins, which have toxic effects on many organs of the body including the heart and blood vessels[16]. The venom affects the myocardium adversely, which may cause deaths directly due to cardiotoxicity[17]. Snake venom modifies the electrophysiological properties of the cardiac cell membrane and can affect on impulse generation and conduction throughout the heart[18]. Most of snake venom cardiotoxins causes cardiomyocyte degeneration by acting on the extracellular surface of cardiomyocytes to increase cytosolic free calcium ions. The subsequent cell degeneration may result from the activities of a Ca^{+2} dependent non lysosomalproteolyticsystems.[19]

The neurotoxic venom act on the pre synaptic membrane, there by blocking inhibition of the neutrally mediated release of norepinephrine. Thus it gives rise to sympathetic over activity and decreased para sympatheticstimulation[20]. In our study there was parasympathetic dominance at the time of admission and after treatment becomes normal level.

CONCLUSION

There is a parasympathetic dominance during the snake bite envenomation after the treatment of antivenom there is sympathetic activity. In snake bite envenomation there is variation in heart rate variability and after the treatment sympathovagal balance is maintained.

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