International Journal of Research in Medical Sciences
Singh S et al. Int J Res Med Sci. 2019 May;7(5):1450-1454
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20191545

Original Research Article

Study of electrocardiographic changes pattern in cases of snake bites in a tertiary care hospital of Mahakaushal area of central India

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Received: 16 March 2019
Accepted: 30 March 2019

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ABSTRACT

Background: Snake bite is an occupational hazard for farmers and farm laborers in the Indian subcontinent. Most snake venom can adversely affect multiple organs. Various ECG changes have been reported in a large percentage of cases of snake bite (particularly viper and krait) from time to time. Thus, cardiotoxicity was studied with ECG.
Methods: This cross-sectional observational study was carried on 84 patients admitted in Ward/ICU, Department Of Medicine, NSCB Medical College, Jabalpur, India on patients of snake bite reporting from all over Mahakaushal area of central India from March 2017 to August 2018.
Results: The commonest manifestation in vasculotoxic snake bite was tachycardia (16.67%). On admission, ECG manifestations were 39.1% in poisonous bites were sinus tachycardia (17.8%), sinus bradycardia (9.5%), nonspecific ST-T changes (5.9%), AV block (3.5%) and sinus arrhythmia (2.3%) of all cases. These ECG changes were 2.3% in nonpoisonous patients. In symptomatic cases mortality was 19% with no mortality was seen in non-poisonous snake bite. There was significant difference between outcome of abnormal ECG group and normal ECG group patients ($p < 0.005$).
Conclusions: There is significant impact of snake poisons on cardiovascular profile and ECG can be a useful tool to predict outcome.

Keywords: Cardiotoxicity, Electrocardiogram, Snake bite

INTRODUCTION

Snake bite is a common medical emergency in most of the countries. Throughout the world snake bites are estimated to account for 30,000 to 40,000 deaths annually.[1] An estimated 15,000-20,000 people die each year from snake bite in India.[2]

The common poisonous snakes found in India are Echis carinatus (saw scaled viper), Vipera Russell (Russell's viper) both of which are predominantly haematotoxic, Naja naja (Indian cobra), Bungarus caeruleus (Krait) which are predominantly neurotoxic.[3]

The snake venom is a complex mixture of enzyme, low molecular weight polypeptides, glycoproteins and metal ions. Various proteolytic enzymes that cause local tissue necrosis also affects the coagulation pathway at various steps or impair organ function, myocardial depressant factors that reduce cardiac output. Most snake venom can adversely affect multiple organs.[4] Various ECG changes have been reported in a large percentage of cases of snake

bite (particularly viper and krait) from time to time. A wide variety of cardiac arrhythmia and conduction disturbances occur but their true incidence and etiopathogenesis is still not known. Reported incidence and type of rhythm disturbances have been found different in studies conducted so far, which may be due to different evaluation and management strategies that were followed.[5-7]

So, cardiac complication is an important cause of morbidity and mortality among these patients. Thus, this study has been planned to deal with assessment of ECG patterns in patients of snake bite.

METHODS

This cross-sectional observational study was carried on 84 patients admitted in Ward/ICU, Department of Medicine, NSCB Medical College, Jabalpur, India on patients of snake bite reporting from all over Mahakaushal area of central India from March 2017 to August 2018.

All the patients of snake bite patients giving the history of snake bite (poisonous, nonpoisonous) or proved case of snake bite on clinical grounds i.e. bite mark, local changes e.g. signs of local inflammation, appearance Of bullae, tingling and numbness over tongue, mouth scalp, purpuric rashes and necrosis as well as systemic manifestation as psychological trauma, flaccid paralysis etc., were included in study. Patients were categorized in vasculotoxic, neurotoxic and non-poisonous snake bites on the basis of history and clinical examination.

While patients with history/signs of bites other than snake and or any cardiovascular disease were excluded from study. All the routine investigations aimed to evaluate the organ damage especially cardiovascular system were done including electrocardiography. A 12 lead ECG was done on the day of admission, 2nd day, and on the day of discharge with "car di art 1087 (BPL Limited) machine" at a paper speed 25 mm/sec. ECG was interpreted according to Schamroth l.[8]

ECG changes for heart rate, rhythm disturbance (arrhythmias), ventricular ectopics, ST-T changes, conduction disturbances, evidences of electrolytic imbalance and myocardial ischemia/infarction were looked for.

Observed data was tabulated for number of patients in abnormal and normal ECG findings, types of ECG abnormality and they were correlated and compared for outcome and as predictor of outcome with help of GraphPad Prism 7.00 statistical software.

RESULTS

Study population consisted of 84 patients of snake bite out of which 63.1% males (n=53) and 36.9% females (n=31) with male preponderance. Most common victims of snake bites were young adult in the age group of 25-49 years with 48.81% (n=41) patients. Most number of patients reported with neurotoxic bites, constituted 50% (n=42), vasculotoxic bites being 36.9% (n=31) and non-poisonous bites were 13.1% (n=11). Most common systemic manifestation in a vasculotoxic bite was tachycardia (16.67%) and hypotension (14.29%) followed by decreased urine output and nausea/vomiting. A total of 39.2% (n=33) patients shown to have positive ECG findings while rest 60.7% (n=51) shown no abnormality in electrocardiogram. Out of all positive ECG, mostly (93.94%, n=32) occurred with poisonous bites. Though the proportion of patients with positive ECG findings was not statistically ($p > 0.05$) different from non-poisonous bites (Figure 1).

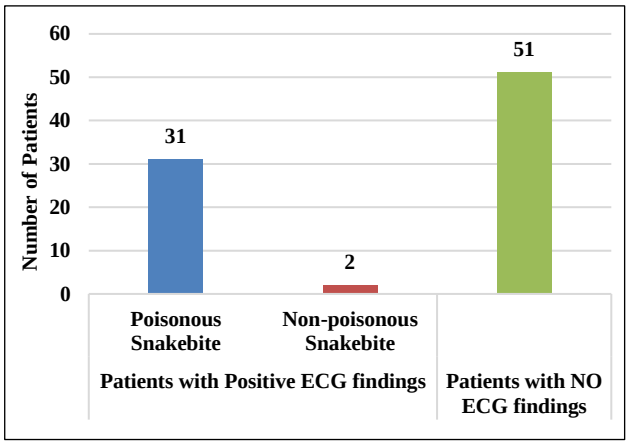

Figure 1: ECG findings in poisonous and non-poisonous bites.

The most common ECG abnormality was sinus tachycardia, presented in 17.8% (n=15) patients followed by sinus bradycardia 9.5% (n=8), ST-T changes in 5.9% (n=5), AV block in 3.5% (n=3) and sinus arrhythmia in 2.3% (n=2). Most common finding of sinus tachycardia was also most common finding with 9 (10.71%) patients in neurotoxic group in inter group distribution pattern ECG findings (Table 1).

In neurotoxic group 23 (27.38%) patients and in vasculotoxic group 19 (22.62%) patients did not show any ECG abnormality. There was no statistically significant difference was seen in ECG pattern distribution among three groups.

As a predictor of outcome of snake bite patients, mortality was significantly higher in patients with abnormal ECG ($p < 0.005$) in vasculotoxic bites. Though the difference in mortality and discharge in two ECG groups of normal and abnormal ECG was not significant ($p > 0.05$) for neurotoxic and non-poisonous bites (Figure 2).

Overall ratio of patients who have stayed more in wards/ICU was increased in abnormal findings in ECG,

but this difference in increase in number of patients who stayed more in abnormal investigations was not significantly higher than that of the group of patients where investigations was normal.

Table 1: Pattern of ECG findings in different types of bites.

ECG changes	Vasculotoxic	Neurotoxic	Non-poisonous	Total
Sinus tachycardia	5	9	1	15
Sinus bradycardia	3	5	0	8
Sinus arrythmia	1	1	0	2
AV block	1	2	0	3
ST-T changes	2	2	1	5
Normal	19	23	9	51
Total	31	42	11	84

Overall mortality was more in cases where there was abnormal ECG in all cases of snake bites. But overall outcome analysis with ECG shown to have no significant impact prediction of outcome in all cases of snake bite.

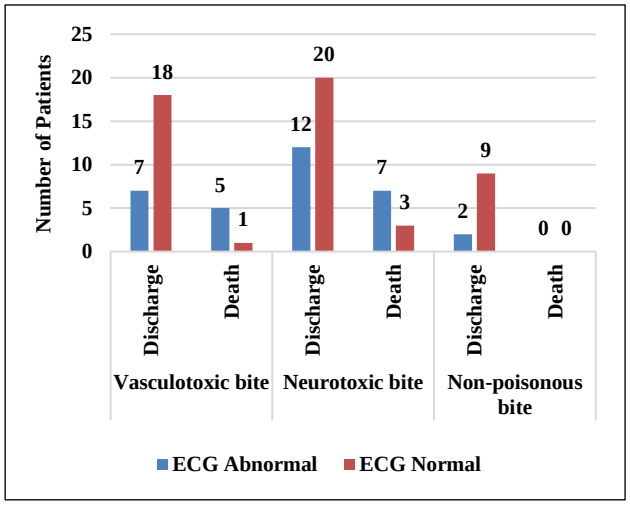

Figure 2: Distribution of patient's findings in ECG and in outcome of different types of bites.

DISCUSSION

Present study was conducted in 84 patients of snake bite to understand pattern of ECG and to render help in the management of the problem arising out of them.

In the present study, most common victims of snake bites were males (63.1%) and young adult in the age group of 25-49 years with 48.81% (n=41) patients in this age.

Identification of offending snake was possible in only 27 (32.14%) cases while snake was type was unknown in 57 (67.86%) patients. Most common bites in known snakes where of cobra with 10 (11.90%) patients, followed by Krait in 7 (8.33%) patients, Russell viper in 6 (7.14%) and Saw scaled viper in 4 (4.76 %) patients. In this study, the common cobra bite is the commonest snake bite observed, this finding is different from other authors from various areas (Rajasthan- Bhargava RK et al), Jammu-Bhat RN, Saini RK et al, Delhi- Banerjee RN, Cuttack-Sarangi A et al).[9-13] This is due to fact that Naja Naja is one of the common snakes in central India.

On admission ECG changes were observed in 39.2% cases which was 42.46% of poisonous snake bites. Common electrocardiographic changes were sinus tachycardia (17.8%), sinus arrhythmia (2.3%), sinus bradycardia (9.5%), non-specific ST-T changes (5.9%) and atrioventricular block (3.5%). The mortality rate was 19% where 6 patients had bleeding manifestations and rest 11 had neurotoxic manifestation, and 12 had abnormal electrocardiograms. Present findings was in accordance with those observed by Sokolovsky M.[14] This cardiotoxicity was attributed to cardiotoxin, which also explain many of the toxic effect of cobra venom such as profound circulatory shock, with cardiovascular depression and sudden death by cardiac arrest (Banerjee RN).[9] These changes can be explained by T inversion due to coronary ischemia resulting from fall in BP and ST-T changes because of thrombosis or subintimal heamorrhage in coronary vessels. Snake venom causes disseminated intravascular coagulation which can lead to thrombosis or subintimal heamorrhage in coronary arteries and producing ECG changes. ST-T changes can be due to hypoglycemia and direct toxic effect of venom of on heart may be a likely explanation for sinus bradycardia, arrhythmias and AV block.[15]

Among 84 patients, 29.77% had tachycardia, 9.5% had bradycardia. In the study by Nayak KC et al, tachycardia was found in 36.7 per cent and bradycardia in 10 per cent cases.[16] The mechanism of cardiac involvement in neurotoxic snake bites is not clear but is likely to be due to one of the myriad toxins seen in snake venom, which can cause morphological changes, enzyme alterations, ultra-structural disturbances and genetic alterations of the myocardial tissue.[17]

In a recent experimental study, analysis of gene expression profiles in mice in response to cobra venom treatment revealed 203 genes in the heart, brain, kidney, liver and lung whose expressions were altered by at least three-fold.[18] Of these, 50% were 58 differentially expressed in the heart, and included genes involved in inflammation, apoptosis, ion transport and energy metabolism.[19-21]

Among the 84 patients, the significant ECG abnormalities were found in 39.1%, while 65% had normal rate and rhythm. Of the 39.1%, 9.5% had sinus bradycardia, 17.8% had sinus tachycardia, sinus arrhythmia in 2.3% and 3.5% had heart block. T wave inversion in precordial leads was present in 5.9%. The ECG changes were transient and recovered after treatment of snake bite. Ventricular ectopics and bundle branch blocks were not found in this study (Pahlajani DB et al, and Hafeez S et al).[22,23] The study by describes electrocardiographic changes were sinus tachycardia, sinus arrhythmia (6.6%), sinus bradycardia (10%), tall T-wave in V2 (3.3%), nonspecific ST-T changes (16.7%) and atrioventricular block (3.3%).[4] In a study by Anitha MS et al, sinus tachycardia was present in 38%, sinus bradycardia in 10%, heart block in 2% Tall-T in 4% and sinus arrhythmia was not present in any of the patients.[24]

In this study, mortality was 19% which is similar to that in the group studied by Sarangi A et al, but high in comparison to 1.96% in Bhatt's series. All these patients had severe envenomation and late hospitalization.[11,13]

ACKNOWLEDGEMENTS

Authors would like to thank staff of Department of General Medicine, NSCB Medical College, Jabalpur, Madhya Pradesh, India for sharing information on snake bite patients.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Singh S, Pall A, Kirar RS. Study of electrocardiographic changes pattern in cases of snake bites in a tertiary care hospital of Mahakaushal area. Int J Res Med Sci 2019;7:1450-4.