AYUSHDHARA
ISSN: 2393-9583 (P)/ 2393-9591 (O)
An International Journal of Research in AYUSH and Allied Systems

Research Article

AN OBSERVATIONAL STUDY OF *VATAJA HRIDROGA* IN CORRELATION WITH ELECTROCARDIOGRAPHIC CHANGES

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Article info
Article History:
Received: 12-11-2022
Revised: 07-12-2022
Accepted: 27-12-2022
KEYWORDS:
Dosha, Vataja Hridroga, Electro-cardiogram, *Anubandha*.

ABSTRACT

Diagnosing a disease is far important before initiating the treatment. Different important and involuntary functions are regulated by different *Dosha, Dhatu* and *Oja*, which are situated in the heart. *Hridroga* is disease of *Marma* and is life threatening. However emphasis is given to explore the possibility of inclusion of electrocardiogram a bedside investigating tool as a support to existing *Pramanas* and *Rugna pariksha*. In accordance with the World Health Organization, India accounts for one-fifth of these deaths worldwide especially in younger population. So the study aimed at comprehension of electrocardiographic changes in patients suffering from *Vataja Hridroga* as mentioned in *Charak samhita, Sushruta Samhita, Ashtanghridaya* and their specific correlation. 100 patients were included in the study and their symptomatology with electrocardiographic changes was observed. *Vata Pradhan Kapha-Pitta Anubandha* observed in 38% patients, *Vata Pradhan Kapha Anubandha* observed in 34% patients, *Keval Vata Pradhanata* observed in 23% patients, *Vata Pradhan Pitta Anubandha* observed in 5% patients. This *Kapha-Pitta Anubandha* indicates its contribution in *Srotorodha Pradhan* and *Avaranatmak Samprapti. Dosha* vitiation and *Anubandha* causes various pathological changes in *Hridaya* like *Shotha, Paka, Srotorodh* thereby leads to specific changes in electrocardiogram. Significant correlation between two were observed.

INTRODUCTION

Disease should be diagnosed first and then the rational therapeutic measures should be employed. Physician, who starts the treatment without diagnosing a disease, succeed by chance even if he is expert in medicine. So diagnosing a disease (*Rognidan*) is far important before initiating the treatment.[1]

Heart is a vital organ, which is very sensitive and having its own inherent rhythm and is the substratum of many vital activities. *Hridroga* is disease of *Marma*. Three *Marmas* are specially identified as high risk centres, *Hridaya* is one of such centres.[2] It is a seat of *Oja* and other body constituent like *Vyanavayu*, *Sadhakapitta*, *Avalambaka kapha*.

Access this article online
Quick Response Code
https://doi.org/10.47070/ayushdhara.v9i6.1116

Many different important and involuntary functions are regulated by different *Dosha*, *Dhatu* and *Oja*, which are situated in the heart. Sushruta stated that, heart is primary seat of consciousness in animated beings.[3]

Any pathology or trauma to this leads to life threatening symptoms or ultimately to death. Industrialization, urbanization and changes in dietary habits are becoming the increased risk factors for cardiovascular diseases. Since *Hridroga* is life threatening disease, its diagnosis is very important. However emphasis is given to explore the possibility of inclusion of ECG as a support to existing *Pramanas* and Ayurvedic *Rugna pariksha*. This may help in early diagnosis. Sushruta stated in *Sutrasthana* that, A Physician cannot assuredly know or understand the science by studying a branch of science hence Physician must study or understand as many allied branches of science as possible.[4]

ECG is one of such tools where bedside investigation is done at both OPD and IPD levels and is a gold standard for diagnosis of rhythm and conduction disturbances. In accordance with the World Health Organization, India accounts for one-fifth of these deaths worldwide especially in younger population. The results of Global Burden of Disease study state age-standardized CVD death rate of 272 per 100000 populations in India which is much higher than that of global average of 235. CVDs strike Indians a decade earlier than the western population.

To prevent and control *Hridroga*, it is required to emphasize on its diagnostic techniques. If Ayurveda practitioners take advantage of modern techniques and instruments available like ECG, they will be in position to show better and effective treatment of *Hridroga*. Therefore, present study was aimed at diagnosis of *Vataja Hridrog* as per Ayurvedic perspectives and later recording the ECG of those patients was done and scope of ECG in diagnostic precision have been explored.

AIM

The study of Electrocardiographic changes in patients suffering from *Vataja Hridroga* as mentioned in *Charak samhita, Sushruta Samhita, Ashtanghridaya*.

OBJECTIVES

The study was planned with following objectives,

1. To study the ECG of patients suffering from symptoms of *Vataj Hridroga*.
2. To study specific correlation between *Vataj Hridroga lakshana* & ECG.
3. Ayurvedic interpretation of ECG in *Vataj Hridroga.*

Table 1: *Lakshana* of *Vataja Hridroga* according to *Charaka, Sushruta, Vagbhata* are given in the table below

Sr. No.	*Lakshana*	Modern term	*Charaka*	*Sushruta*	*Vagbhata*
1.	*Vepathu*	Tremors	+	-	+
2.	*Veshtana*	Cardiac cramps	+	-	+
3.	*Stambh*	Bradycardia	+	-	-
4.	*Pramoha*	Confused state	+	-	-
5.	*Hrutshyunyata*	Emptiness in heart	+	-	-
6.	*Dara*	Palpitation	+	-	-
7.	*Jirne atyarthe vedana*	Post prandial pain	+	-	-
8.	*Hrutshul*	Chest pain			
8a.	*Ayamyate*	Dilatation pain	-	+	-
8b.	*Tudyate*	Pricking pain	-	+	+
8c.	*Veshtana*	Squeezing pain	+	-	+
8d.	*Nirmatyate*	Piercing pain	-	+	-
8e.	*Diryate*	Cutting pain	-	+	-
8f.	*Spotyate*	Breaking pain	-	+	+
8g.	*Patyate*	Splitting pain	-	+	+
8h.	*Bhidyate*	Piercing pain			
9.	*Shulyate Atyarthe*	Severe pain	-	-	+
10.	*Shosha*	Sense of dryness	-	-	+
11.	*Drava*	Tachycardia	+	-	-
12.	*Aksmat Dinata*	Fatigue	-	-	+
13.	*Shwasavrodha*	Dyspnea	-	-	+
14.	*Shoka*	Grief	-	-	+
15.	*Bhaya*	Fear	-	-	+
16.	*Shabdasahihnuta*	Intolerance to sound	-	-	+
17.	*Alpanidra*	Insomnia	-	-	+
18.	*Stabdhata*	Bradycardia	-	-	+

MATERIAL AND METHODS

The study was conducted in two phases,

1. Conceptual: All references regarding *Vataja Hridroga* were studied from *Samhita*, Textbook of Pathology, research articles. Also information related to ECG was studied ECG books, articles and websites.
2. Clinical: In clinical study, changes in ECG patterns studied in patients of *Vataja Hridroga*.

Place of work- IPD and OPD of Ayurveda Hospital.

Duration of study- Total duration of study was of 16 months.

Sample size calculation

According to Daniel's formula (1999):

$n = z^2 p (1-p) / d^2$

$n = [(1.96)^2 \times 0.07 (1 - 0.07)] / (0.05)^2$

n = 100.0352

Where -

n = Sample size

z = Statistical level of confidence = 1.96

p = Prevalence rate = 7% (p = 0.07)[6]

d = Precision 5% (d = 0.05)

Though sample size by formula was 100.0352, for sake of convenience sample size was taken 100.

Sampling Technique

Patients were selected by simple random sampling technique irrespective of age, sex, religion, socioeconomic status, education etc.

Method of selection of study subjects (Eligibility criteria)

a) Inclusion Criteria

- ✓ Patients presenting with symptoms of or related to *Vataja Hridroga* according to *Charak samhita, Susruta samhita, Ashtang hridaya*.
- ✓ Age between 25 to 69 years. [6]
- ✓ Patients previously diagnosed as heart disease later on examined for *Lakshanas* of *Vataja Hridroga*.
- ✓ Patients of either sex.

b) Exclusion Criteria

- ✓ Pregnant women, lactating women.
- ✓ Patients suffering from trauma, coma.
- ✓ Unconscious and non co-operative patients.
- ✓ Patients who need emergency medicines.
- ✓ Terminally ill patients with multiple diseases.

c) Diagnostic criteria

- ✓ *Dara* [7] – Palpitation
- ✓ *Hruddrava* [8] – Tachycardia
- ✓ *Hrutshool* – Chest pain
- ✓ *Akasmatdinata* – fatigue
- ✓ *Shwasrodha* – Dyspnoea
- ✓ *Hrutstambh* [9] – Bradycardia

d) Assessment criteria – A. Subjective – Gradations [10]

Vepathu/Kamp – Tremors

Absent	0
Occasionally Present	1
Mildly present one times feeble	2
Moderately present i.e., visible disturbs holding light weight articles	3
Severely present not able to do routine work like buttoning, eating etc.	4

Hrutstambh – Bradycardia

60-100 bpm	0
50-60 bpm	1
40-50 bpm	2
<40 bpm	3

Pramoha- Confused state

Absent	0
Present	1

Hruddrava - Tachycardia

Between 60-100 bpm	0
Non-sustained VT – 100-150	1
Sustained VT – 150-250	2
Ventricular flutter - 150-300	3

Jirneathyarth vedana- Postprandial chest pain

Absent	0
Mild	1
Moderate	2
Severe	3

Hrutshool- Anginal Chest pain NYHA classification [11]

Class I	No limitations. Ordinary physical activity does not cause undue fatigue, dyspnoea or palpitations
Class II	Slight limitation of physical activity. Ordinary physical activity results in fatigue, palpitation, dyspnoea or angina pectoris
Class III	Marked limitation of physical activity. Less than ordinary physical activity leads to symptoms
Class IV	Unable to carry on any physical activity without discomfort. Symptoms of CHF present at rest

- *Veshtana*- Squeezing/cardiac cramps
- *Tudyate*- Pricking pain/crushing pain
- *Nirmathyate*- Churning pain/piercing pain
- *Deeryate*- Cutting pain
- *Sphotyate*- Breaking pain
- *Patyate*- Splitting pain
- *Bhidyate*- Piercing pain
- *Shulyate athyartha*- Severe pain

1. *Akasmatdinata* – Fatigue NYHA
2. *Dara* - Palpitation NYHA
3. *Shwasavarodh*- Dyspnoea NYHA
4. *Alpanidra*- Insomnia

6-8 hrs sleep/24hrs	0
4-6 hrs sleep	1
2-4 hrs sleep	2
0-2 hrs sleep/24hrs	3

5. *Bhaya*- Fear

Normal functioning capacity	0
Gradual affliction towards objects	1
Increased affliction, often towards objects	2
Totally involvement & affliction with object	3

6. *Shabdasahishnuta*- Intolerance to sound

Absent	0
Present	1

7. *Shoka* - Grief

Absent	0
Present	1

8. *Hrudshunyata* – Emptiness in heart

Absent	0
Present	1

Functional gradation of Heart disease by NYHA- Classification of fatigue, palpitation, dyspnea, angina pain

B. Objective – ECG parameters [12]

- Rate
- Rhythm
- Voltage
- Axis
- Position
- Rotation
- P wave
- PR interval
- QRS complex
- QRS duration
- ST segment
- T wave
- QTc interval
- U wave

Study Design

Single open labelled observational study

⇩

Screening the subjects for inclusion criteria

⇩

Random selection of 100 patients of *Vataja Hridroga*

⇩

Lakshana of *Vataja Hridroga* recorded and assessed

⇩

ECG of each patient obtained and studied carefully

⇩

Obtained data analyzed as observed

⇩

Result and observations

⇩

Conclusion

OBSERVATIONS

Table 2: Out of 100 patients observed, following percentage of *Vataja Hridroga Lakshana*

S. No.	***Lakshana***	**Modern term**	**Percentage**
1.	*Vepathu*	Tremors	51%
2.	*Veshtana*	Bradycardia	30%
3.	*Stambh*	Confused state	74%
4.	*Pramoha*	Emptiness in heart	00
5.	*Hrutshyunyata*	Palpitation	100%
6.	*Dara*	Post prandial pain	87%
7.	*Jirne atyarthe vedana*	Dyspnoea	100%
8.	*Hrutshul*	Chest pain	100%
8a.	*Ayamyate*	Dilatation pain	00
8b.	*Tudyate*	Pricking pain	54%
8c.	*Veshtana*	Squeezing pain	45%
8d.	*Nirmatyate*	Piercing pain	40%
8e.	*Diryate*	Cutting pain	03%
8f.	*Spotyate*	Breaking pain	03%
8g.	*Patyate*	Splitting pain	01%
8h.	*Bhidyate*	Piercing pain	05%
9.	*Shulyate Atyarthe*	Severe pain	54%

10.	*Shosha*	Sense of dryness	00
11.	*Drava*	Tachycardia	51%
12.	*Aksmat Dinata*	Fatigue	100%
13.	*Shwasavrodha*	Dyspnea	100%
14.	*Shoka*	Grief	51%
15.	*Bhaya*	Fear	96%
16.	*Shabdasahihnuta*	Intolerance to sound	44%
17.	*Alpanidra*	Insomnia	38%
18.	*Stabdhata*	Bradycardia	30%

Table 3: ECG parameters- Statistical analysis (by chi-square test)

	Normal	Abnormal	Total	Chi-Square	Table Value	P-Value	Result
Rate	47	53	100	25.765	3.841	0.000	Significant
Rhythm	48	52	100	25.842	3.841	0.000	Significant
Voltage	69	31	100	14.440	3.841	0.000	Significant
Axis	77	23	100	29.160	3.841	0.000	Significant
Position	60	40	100	4.000	3.841	0.027	Significant
Rotation	90	10	100	64.000	3.841	0.000	Significant
P wave	88	12	100	57.760	3.841	0.000	Significant
PR interval	83	17	100	43.560	3.841	0.000	Significant
QRS Complex	35	65	100	9.000	3.841	0.001	Significant
QRS duration	96	4	100	84.640	3.841	0.763	Not Significant
ST Segment	36	64	100	7.840	3.841	0.003	Significant
T Wave	29	71	100	17.640	3.841	0.000	Significant
QTc Interval	60	40	100	4.000	3.841	0.027	Significant
U Wave	99	1	100	96.040	3.841	0.843	Not Significant

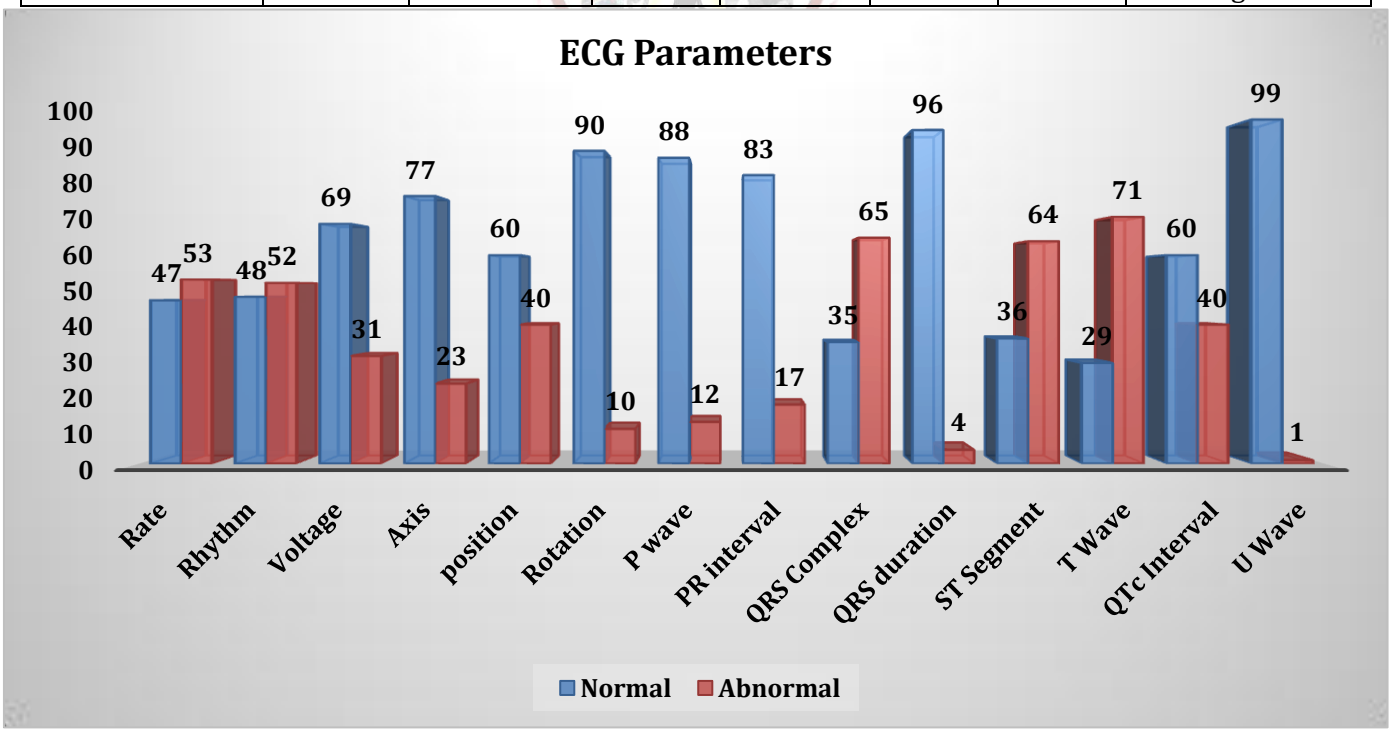

Chart: 01- ECG Parameters

H_0: There are no significant changes in ECG patterns observed in patients suffering from *Vataj Hridroga*.

H_R: There are significant changes in ECG patterns observed in patients suffering from *Vataj Hridroga*.

Table 4: Correlation of *Vataj Hridroga Lakshana* with ECG Pattern Changes

Vataj Hridroga Lakshana	**Test**	**ECG Pattern Changes**
Vepathu	Likelihood ratio	15.789
	P-Value	0.000
	Significance	**Significant**
Hrutstambh	Likelihood ratio	18.416
	P-Value	0.000
	Significance	**Significant**
Pramoha	Likelihood ratio	17.976
	P-Value	0.000
	Significance	**Significant**
Hruddrav	Likelihood ratio	16.003
	P-Value	0.000
	Significance	**Significant**
Jirneathyarthe	Likelihood ratio	19.827
	P-Value	0.000
	Significance	**Significant**
Hrotshool	Likelihood ratio	24.502
	P-Value	0.000
	Significance	**Significant**
Akasmatdinata	Likelihood ratio	19.581
	P-Value	0.000
	Significance	**Significant**

Vataj Hridroga Lakshana	**Test**	**ECG Pattern Changes**
Dara	Likelihood ratio	25.560
	P-Value	0.000
	Significance	**Significant**
Shwasavarodh	Likelihood ratio	24.181
	P-Value	0.000
	Significance	**Significant**
Alpanidra	Likelihood ratio	20.025
	P-Value	0.000
	Significance	**Significant**
Bhaya	Likelihood ratio	24.435
	P-Value	0.000
	Significance	**Significant**
Shabdasahishnu	Likelihood ratio	20.020
	P-Value	0.000
	Significance	**Significant**
Shoka	Likelihood ratio	19.565
	P-Value	0.000
	Significance	**Significant**
Hrudshunyata	Likelihood Ratio	24.494
	P-Value	0.000
	Significance	**Significant**

DISCUSSION

As *Hridaya* is a *Mulasthana* of *Pranavaha* and *Rasavaha Srotas*, causes affecting them also responsible for *Hridroga*. *Vataja Hridroga* can occur in two ways by *Srotorodhajanya* and *Dhatu Kshayajanya Samprapti* depending on *Dosha anubandhatwa* and their characters involved.

CRF (Case Record Form) was used to fill the information of the patient. Thorough clinical examination and history taking was done and collected data was recorded in the CRF. The data was collected on 100 patients. The collected is on nominal scale qualitative data. In accordance with the statistical analysis to be performed to test the significance, chi – square is the appropriate statistical test for the same. The statistical analysis is performed using chi – square test with the level of significance as 5% (0.05).

The variation in rate is due to *Visham, Chala* character of *Vayu*. Also *Manda, Sara* characters of *Kapha* and *Pitta* accountable for disturbance in *Chala* character of *Vayu* and aggravation of *Visham* character. [13]

The variation in rhythm is due to *Chala* character dysfunction of *Vata*. *Chala, Laghu* together with *Sara* and character of *Pitta dosha* causes increased heart rate. When *Chala Guna* of *Vata* is predominated by *Manda, Sthira Guna* of *Kapha* causes decrease heart rate but *Visham guna* has no role to play. In AF, SVT, irregularity *Visham, Sukshma, Tikshna Guna* are taking advantage of depleted contrary *Guna*.

High voltage signifies ventricular hypertrophy, it may be due to *Bahal, Guru, Sthira guna (Balasaka)*[14] of *Kapha* together with *Ruksha*, *Sheeta guna* of *Vata* or may be due to *Drava guna* of *Kapha-Pitta* causes excessive load over *Vyana Vayu* leading to *Vikrita Mamsa Vridhi*, low voltage due to obesity and thick chest wall.

The mean electrical axis of the QRS is the mean of the total depolarization in the ventricles. This correlates with the electrical activity of the heart which is the normal *Vyana Vayu* activity. *Guru, Sthira, Ruksha* characters by causing hypertrophy as well as *Chala, Vishama, Tikshna, Manda, Sheeta* characters by causing arrhythmia and blocks lead to abnormal axis.

PR interval represents time interval between atrial and ventricular depolarization. So if PR is prolonged it means delay in conduction which may be due to disturbed *Chala guna* or due to *Manda, Sheeta guna* of *Kapha avarana* over *Vyana Vayu*. Short PR may be observed due to *Chala, Tikshna, Sara guna* of *Vata-Pitta.*

QRS represents the time taken for ventricular depolarization, contraction and relaxation is a function of *Vyana Vayu*. *Chala, Snigdha, Shlakshna guna* help in contraction and relaxation.

Q wave suggests necrosis of myocardium, conduction abnormalities, LVH. According to Sushruta [15] and According to Bhela[16], *Kapha-Pitta* causes *Avarodha* of *Rasa* leading to *Shotha* by *Drava- Ushna guna* and *Vyana* function disturbance progressing to *Paka* [17] *Pradhan samprapti* of *Hridaya Mamsa* thereby causing *Kotha* [17] which may be presented by Q wave on ECG.

Prolonged QRS indicates BBB, Conduction defects which may be due to disturbed *Chala guna* or due to *Manda, Sheeta guna* of *Kapha avarana* over *Vyana Vayu.*

Normally it represents the time between ventricular depolarization and repolarization, abnormality indicates myocardial injury. Contraction and relaxation is a function of *Vyana Vayu*. *Chala, Snigdha, Shlakshna guna* help in contraction and relaxation. *Kapha-Pitta* causes *Avarodha* of *Rasa* leading to *Shotha* by *Drava- Ushna guna* and *Vyana* function disturbance by *Chala guna* represented by continuous elevated or depressed ST segment.

It is produced by ventricular repolarization, inverted, tall; Flat T indicates myocardial ischemia, strain, digoxin toxicity, subendocardial ischemia etc. According to *Sushruta* and *Bhela*, when the blood vessels attached to heart are obstructed due to *Kapha* and *Pitta* the nutrients are not supplied to the heart properly thereby aggravated *Vata* gives rise to pain. [15,16] *Kapha-Pitta* causes *Avarodha* of *Rasa* leading to *Shotha* by *Drava- Ushna guna* and *Vyana* function disturbance progressing to *Paka Pradhan samprapti* of *Hridaya Mamsa* which may be indicated by T wave abnormality.

Represents the duration of ventricular systole, depolarisation and repolarisation is a function of *Vyana Vayu*. *Chala, Snigdha, Shlakshna guna* help in systole. QTc abnormality may occur due to *Vyana* function disturbance by *Chala*, *Tikshna, Sukshma guna* decrease QTc and *Manda, Guru, Sheeta, Sthir guna* increase Qtc.

Dosha Pradhanata

Vata Pradhan Kapha-Pitta Anubandha observed in 38% patients, *Vata Pradhan Kapha Anubandha* observed in 34% patients, *Keval Vata Pradhanata* observed in 23% patients, *Vata Pradhan Pitta Anubandha* observed in 5% patients. This *Kapha-Pitta Anubandha* indicates its contribution in *Srotorodha Pradhan* and *Avaranatmak Samprapti.*

Vata Prakopa: In this study 72% patients are found to have *Srotorodhajanya Samprapti*, 28% patients are observed to have *Dhatukshyajanya Samprapti.*

According to *Charaka, Vata Prakopa* occurs in two ways by *Dhatukshayat* or *Margavaranat.*[18] Same observed in the study, depletion of tissue elements and occlusion of its channels of circulation. Because of its subtle nature, *Vata dosha* provokes and pulls *Pitta* and *Kapha dosha.* The aggravated *Vata* spreads *Pitta* and *Kapha* into different places of the body and obstructs the channels of circulation leading to the manifestation of the disease. *Sheeta, Styana, Snigdha, Picchila* characters of *Kapha* are responsible for *Srotorodha*. Similarly *Drava, Snigdha* characters of *Pitta* are responsible for *Srotorodha samprapti* by participating into *Agni* vitiation and *Ama* production. Decreased *Snigdha, Drava, Sheeta* characters and increased *Ushna, Tikshna, Khara, Ruksha, Laghu, Chala, Sara* characters causes *Dhatukshaya.* All above pathogenesis leads to dysfunction of *Hridaya* structurally and functionally and playing crucial role in development of *Hridroga*.

Significant correlation between *Vataj Hridroga Lakshana* and ECG pattern changes were observed. When all parameters of ECG are collectively tested with *Vataja Hridroga Lakshana*, they are found to be significant as Chi-square values are far less than 0.05.

CONCLUSION

- *Vataja Hridroga* is extremely common amongst individuals over the age of 61 years.
- Irregular diet (*Visham Ahar, Vishamashan, Adhyashana, Alpashana), Kshudhsmandya* are seen in most of the patients. *Katu* (pungent), *Lavana* (salty) *Rasapriti* is seen in most of the patients.
- Sedentary work is seen in majority of the patients followed by history of heavy work or field work. 99 patients are found to have addiction.
- *Chinta* (anxiety) is found in most of the patients followed by *Shoka* and *Bhaya* indicating *Manovaha Srotodushti*. *Vikrut Nidra* (disturbed sleep) is found as symptom of *Vataja Hridroga* and as an etiological factor too.
- In clinical presentation of *Vataja Hridroga*, *Hritshool* (chest pain), *Dara* (palpitation), *Hruddrava* (tachycardia), *Shwasavarodha* (dyspnea), *Vepathu* (tremors), *Akasmatdinata* (fatigue), *Pramoha*, *Jirneathyarthe vedana* (postprandial chest pain), *Bhaya* (fear), *Shoka* (grief), *Shabdas- ahishnuta* (intolerance to sound) are seen most commonly except *Hrudshunyata* (emptiness in heart).
- 98 patients out of 100 are found with abnormal ECG patterns in which pathological Q wave, ST segment and T wave abnormalities are significantly seen to be present followed by Rate and Rhythm disturbances in ECG.
- *Rasavaha Srotodushti* is seen in all patients followed by *Purishvaha Srotodushti* predominantly presented by *Mala vibandha* as symptom and *Sweda pravartana* as an additional symptom in *Vataja Hridroga*.
- In majority of the patients *Vata Pradhan Kaph-Pitta Anubandh* is seen followed by *Vata Pradhan Kapha Anubandh* and *Vata dosha pradhanata* alone especially.
- *Srotorodhajanya* pathogenesis is seen to be present in most of the patients and *Dhatukshayajanya* pathogenesis in few patients from ECG changes observed.
- It is concluded that there are specific changes observed in ECG patterns of patients suffering from *Vataja Hridroga*.
- *Vataja Hridroga* signs and symptoms have significant correlation with ECG pattern changes.
- ECG helps in diagnosis of *Vataja Hridroga* and various stages of the disease progression can be anticipated.
- *Dosha* involved and their *Anubandha* can be speculated with their *Guna* responsible by observing ECG.
- From ECG changes like ST, T, Q, PR, Axis, Rate and Rhythm disturbances together with clinical signs and symptoms and etiological background, diagnostic precision can be achieved in *Vataja Hridroga*.

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Cite this article as:
Parekar Anil Popat. An Observational Study of Vataja Hridroga in Correlation with Electrocardiographic Changes. AYUSHDHARA, 2022;9(6):48-57.
https://doi.org/10.47070/ayushdhara.v9i6.1116
Source of support: Nil, Conflict of interest: None Declared

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