

Correlation of Myocardial Infarction with Palmar Dermatoglyphic Pattern : A Comparative Dermatoglyphic study

Dr. Pawan Kumar Mahato¹, Reenu Kumari², Dr. Nivedita Pandey³,
Amod Kumar Yadav⁴

1. Associate Professor, Department of Anatomy, Shri Shankaracharya Institute of Medical Sciences, Bhilai, Chhattishgarh.
2. Assistant Professor, Department of Anatomy, NC Medical College and Hospital, Israna, Panipat, Haryana.
3. Professor and Head of Department, Department of Anatomy, NC Medical College and Hospital, Israna, Panipat, Haryana
4. Demonstrator, Department of Microbiology, Pt B.D. Sharma Post Graduate Institute of Health Sciences, Rohtak, Haryana.

Corresponding Author:

Reenu Kumari, Assistant Professor, Department of Anatomy, NC Medical College and Hospital, Israna, Panipat, Haryana, shreejaimahakal@gmail.com

Abstract

Background: The myocardial infarction, commonly known as heart attack, is caused by coronary artery disease, and it remains a major cause of mortality globally. Since MI is prevalent in both developed and developing countries, there is need for a simple and cost effective tool for screening. Hereby we shall study the north Indian population with its genetic disposition on myocardial infarction in co-relation with the dermatoglyphic pattern of palm and fingers. According to the available literature, there has been found a genetic correlation between the dermatoglyphics and myocardial infarction. The present study is also to test the same hypothesis to find out any correlation and its uses as a diagnostic tool. The present study was conducted after taking informed consent form from 150 patients of myocardial infarction as cases while 150 normal health individual were included in the study as controls. Fingerprints were taken using the method described by Cummin and Mildo [1,2]. The earlier studies shows that the important palmar dermatoglyphics pattern that are a-b ridge count and atd angle have a specific position and pattern which is markedly different in Myocardial infarction cases and control. On statistical analysis a small decrease in the mean value of ab ridge count was reported in Myocardial Infarction males and Myocardial Infarction (M+F), when compared with controls. On the contrary there was a small increase in mean value of ab ridge count in Myocardial Infarction females as compared to control females. In case of atd angle, it was reported that there is increase in the mean value of at angle in Myocardial infarction males and females as compared to controls. Similarly the increase was also found in both right and left hands in Myocardial Infarction when compared between the two groups. Dermatoglyphics and Myocardial infarction has shown a close correlation due to genetic disposition. Thus it can be used as one of the cost effective diagnostic tool for early diagnosis of pre disposition of Myocardial Infarction.

Keywords: Myocardial Infarction (MI), Dermatoglyphics, a-b ridge count, atd angle.

Introduction

Dermatoglyphics is the scientific study of fingerprints, lines, mounts and shapes of hands as well as certain body parts such as palms, fingers, soles, and toes, where hair usually does not grow and ridges allow for increased leverage when picking up objects or walking barefoot. These ridge patterns are formed during early embryonic life and remain permanent throughout an individual's life.

The study of dermatoglyphics dates back to 19th century when Joh E. Purkinje [3] started the scientific investigation of papillary ridges in the hands and feet in 1823. Later, Sir William Herschel recognised the value of fingerprints for identification in India 1858 [4]. However, it was Sir Francis Galton who conducted extensive research on the importance of skin ridge patterns and published his work on fingerprints in 1892 [5], significantly advancing the science of fingerprint identification. Dr Harold Cummins, in 1929, alongside Charles Midlo [2] and others, published the influential book "Fingerprints, Palms, and Soles," further contributing to the field of dermatoglyphics.

The Embryology of hand dermatoglyphics refers to the development and formation of unique patterns and ridges found on the skin of hand. Around the 10th week of gestation, the epidermal layer of developing fetus starts to form ridges and furrows on the palms and soles, which later extend to the fingers and toes [6]. The ridges are influenced by genetics and environmental factors, and their formation is believed to be associated with the movement and growth of underlying structures during development. Multiple genes are involved in the formation of dermatoglyphic patterns, and variations in these genes can lead to different ridge patterns and configurations [7].

The hypothesis behind present study is based on the correlation between specific dermatoglyphic pattern and presence of MI. The myocardial infarction, commonly known as a heart attack, is caused by coronary artery disease, and it remains a major cause of mortality globally. Since MI is prevalent in both developed and developing countries, there is a need for simple and cost effective tool to screen individuals without known major risk factors for early detection and management of disease [8]. Aim of the study to find out whether a specific dermatoglyphic trait/feature exists in Myocardial Infarction and its significance as a screening tool for Myocardial Infarction .

MATERIAL AND METHODS:

The present study was carried out in Department of Anatomy, NC Medical College and Hospital, Panipat, Haryana. The data was collected from regional private cardiac hospitals of Panipat, Haryana. After taking permission from the College Ethical Committee the study was started in may, 2020. Informed consent of 150 patients (120 males and 30 females) of myocardial infarction, angina and Ischaemic Heart Disease of the age group 30-70 years, confirmed by clinical findings and ECG reports was taken before taking fingerprints. Bilateral rolled fingerprints were taken from the confirmed Myocardial Infarction cases by ink method as developed by Cummins and Midlo [1,2]. While the control group data was collected from 150 normal healthy individuals by similar procedure. As it is an non-invasive method, no side effects

were there. The participants identity was kept in anonymity and every aspect of the study was thoroughly explained in local language before signing the consent form.

Materials: Duplicating black ink , Ink dropper, Rubber roller, Glass inking slab, Cotton puff , Executive bond paper.

Method Used:

Among the various number of methods used for recording dermatoglyphics like ink method, inkless method, transparent adhesive tape method, photographic method etc., the most routinely used one i.e. the “INK METHOD” described by Cummin(1936) [1] and Cummin and Midlo (1961) [2] was used for this study.

Steps involved in the method:

1. The subjects were asked to clean their hands with soap and water. They were also asked to dry their hands but to leave some moisture.
2. The requisite amount of ink daub was placed on the glass slab. It was uniformly spread by the rubber roller to get a thin even ink film on the glass slab.
3. The thin film of ink was applied on the palm by passing the inked rubber roller uniformly over the palm and digits taking care that the hollow of the palm and the flexor creases of the wrist were uniformly inked.
4. The palm was examined for the uniformity of the ink, and if found otherwise, ink was also applied to the hollow of the palm with the help of cotton puffs.
5. Left hand of the subject was then placed on the sheet of paper from proximal to distal end. The palm was gently pressed between inter-metacarpal grooves at the root of fingers, and on the dorsal side corresponding to thenar and hypothenar regions. The palm was then lifted from the paper in reverse order, from the distal to proximal end. The fingers were also printed below the palmar print by rolled finger print method. The tips of the fingers were rolled from radial to ulnar side to include all the patterns.
6. The same procedure was repeated for right hand on separate paper.
7. The printed sheets were coded with name, age, sex for case group (Myocardial Infarction) and control group.
8. The prints were then subjected for detail dermatoglyphic analysis with the help of magnifying hand lens and ridge counting was done with the help of a sharp needle. The details were noted on the same paper with the pencil.

Inclusion Criteria :

1. Medically confirmed cases of Myocardial Infarction.
2. Myocardial Infarction Patients of age group 30-70 years.
3. Normal healthy individuals of age group 30-70 years for control group.

Exclusion Criteria:

1. Patients with any kind of congenital anomaly.
2. The individuals with systemic hypertension, dyslipidemia and previous history of coronary heart disease were excluded from controls.

RESULTS AND DISCUSSION:

Mean Age of male cases 57.3 years while mean age of female patients was 53.7 years. Male Control 58 years, female control 54 years.

Table 1: Frequency distribution of no. of a-b Ridge count in Myocardial Infarction

a-b Ridge count	Male				Female			
	R	L	Total	%	R	L	Total	%
26-30	4	2	6	2.5	1	1	2	3.33
31-35	23	20	43	17.91	4	6	10	16.67
36-40	65	52	117	48.75	16	12	28	46.67
41-45	20	20	40	16.67	5	6	11	18.33
46-50	4	20	24	10	2	3	5	8.33
51-55	4	5	9	3.75	2	1	3	5
56-60	0	1	1	0.41	0	1	1	1.67
Mean	36.9	37.12	39.44	-	38.03	46.2	43.1	-

M- Male F - Female
R- Right L- Left

Table 2: Frequency distribution of no. of a-b Ridge count in Control

a-b Ridge count	Male				Female			
	R	L	Total	%	R	L	Total	%
26-30	8	3	11	4.58	1	3	4	6.67
31-35	25	14	39	16.25	3	8	11	18.33
36-40	30	30	60	25	6	3	9	15
41-45	49	48	97	40.41	16	10	26	4.33
46-50	5	19	24	10	2	2	4	6.67
51-55	2	3	5	2.08	2	3	5	8.33
56-60	1	3	4	4.67	0	1	1	1.67
Mean	37.9	40.31	40.56	14.71	41.1	39.2	38.9	

M- Male F - Female
R- Right L- Left

Table 3: Statistical Calculation for a-b ridge count in total Myocardial Infarction cases and control

Subject	Sex	side	Mean	SD
MI	M	R	36.9	4.672
		L	37.12	6.017
		R+L	39.44	5.763
	F	R	38.03	5.215

		L	46.2	10.021	
		R+L	43.1	7.342	
		M+F	R	38.1	4.991
		L	40.91	6.432	
		R+L	40.01	5.723	
Control	M	R	37.9	5.552	
		L	40.31	5.627	
		R+L	40.56	5.897	
	F	R	41.1	5.386	
		L	39.2	6.989	
		R+L	38.9	6.487	
	M+F	R	38.56	5.653	
		L	41.21	5.983	
		R+L	40.37	5.843	

M- Male F - Female
R- Right L- Left

Table 4: Test of Significance for a-b ridge Count for comparison between MI and Control

Comparison	t-value	p value	Remark
NMR*CMR	2.3914	0.0259	S
NML*CML	2.874	0.0111	S
NM(R+L)* CM(R+L)	1.294	0.0992	NS
NFR*CFR	1.436	0.1863	NS
NFL*CFL	3.682	0.0021	S
NF(R+L)*CF(R+L)	2.0712	0.0413	S
NTR*CTR	2.4358	0.0115	S
NTL*CTL	0.8838	0.3829	NS
NT(R+L)* CT(R+L)	0.9107	0.3602	Ns

NM - Normal Male
CF - Case Female

CM - Case Male
NF - Normal Female

N(M+F) – Normal Males + Females
S- Significant

C(M+F) - Case Male + Female
NS – Not Significant

The maximum percentage of ab ridge count is observed in the frequency of 36-40 (48.75%) in case of Myocardial Infarction Males. Similarly in case of Myocardial Infarction females the maximum percentage was observed between 36-40 (46.67%). On the other hand, in control males it was found to be in the range between 41-45 (40.41) and in control females it was seen between 31-35 (18.33).

On statistical analysis a small decrease in the mean value of ab ridge count was reported in Myocardial Infarction males and Myocardial Infarction (M+F), when compared with controls. On the contrary there was a small increase in mean value of ab ridge count in Myocardial Infarction females as compared to control females.

Table 5: Frequency distribution of atd angle in Myocardial Infarction

Atd angle	Male				Female			
	R	L	Total	%	R	L	Total	%
26-30	4	2	6	2.5	1	1	2	3.33
31-35	23	20	43	17.91	4	6	10	16.67
36-40	65	52	117	48.75	16	12	28	46.67
41-45	20	20	40	16.67	5	6	11	18.33
46-50	4	20	24	10	2	3	5	8.33
51-55	4	5	9	3.75	2	1	3	5
56-60	0	1	1	0.41	0	1	1	1.67
Mean	38.7	39.9	42.1	-	39.5	42.6	41.1	-

Table 6: Frequency distribution of atd angle in Control

Atd angle	Male				Female			
	R	L	Total	%	R	L	Total	%
26-30	1	0	1	0.41	0	0	0	0
31-35	17	16	33	13.75	3	2	5	8.33
36-40	71	62	133	55.41	13	17	30	50
41-45	25	26	51	21.25	11	9	20	33.33
46-50	3	11	14	5.83	2	2	4	6.67
51-55	2	4	6	2.5	1	0	1	1.67
56-60	1	1	2	0.83	0	0	0	0
Mean	38.7	39.7	39.1	-	40.6	39.6	37.2	-

Table 7: Statistical Calculation for atd angle in total Myocardial Infarction cases and control

Subject	Sex	side	Mean	SD
MI	M	R	38.7	6.5210
		L	39.9	5.4765
		R+L	42.1	5.876
	F	R	39.5	5.523
		L	42.6	5.334
		R+L	41.1	5.653
	M+F	R	43.1	5.220
		L	41.2	5.790
		R+L	41.5	5.559
Control	M	R	38.7	4.491
		L	39.7	4.786
		R+L	39.1	5.765
	F	R	40.6	5.347
		L	39.6	4.661
		R+L	37.2	5.432
	M+F	R	38.6	4.398
		L	39.8	5.876
		R+L	38.7	4.875

Table 8: Test of Significance for atd angle for comparison between MI and Control

Comparison	t-value	p value	Remark
NMR*CMR	0.0141	0.9337	NS
NML*CML	1.001	0.2813	NS
NM(R+L)* CM(R+L)	4.5344	0.0001	S
NFR*CFR	0.7710	0.4192	NS

NFL*CFL	1.4889	0.07221	NS
NF(R+L)*CF(R+L)	0.7128	0.3902	NS
NTR*CTR	0.6892	0.0001	S
NTL*CTL	2.4152	0.0179	S
NT(R+L)* CT(R+L)	4.9973	0.00001	S

NM - Normal Male

CF - Case Female

N(M+F) – Normal Males + Females

S- Significant

CM - Case Male

NF - Normal Female

C(M+F) - Case Male + Female

NS – Not Significant

In Myocardial Infarction males, the maximum percentage of atd angle is observed in the frequency range of 36-40 (48.75%) as compared to control males. Whereas in Myocardial Infarction females the maximum percentage of atd angle is seen between. On statistical analysis, it was reported that there is increase in the mean value of atd angle in Myocardial infarction males and females as compared to controls. Similarly the increase was also found in both right and left hands in Myocardial Infarction when compared between the two groups.

On comparing the t-value for atd angle, it was observed that there is statistically significant difference in mean value of atd angle in Myocardial Infarction cases ($p < 0.001$) & in both Right and Left hands of total Myocardial Infarction cases ($p < 0.005$). No statistically significant difference was observed in atd angle in Myocardial Infarction females.

Discussion:

Dermatoglyphics has been identified as a diagnostic tool in a number of genetic disease. Genetics undeniably is a major factor in myocardial infarction suggesting the correlation between genes, MI and dermatoglyphic patterns. The present study was based on the same hypothesis to find out any such relation and its statistical importance to use it as a screening test in future. The findings of this study were compared with the available literature.

a-b ridge count

In the present study, it was observed that The maximum percentage of ab ridge count is observed in the frequency of 36-40 (48.75%) in case of Myocardial Infarction Males. Similarly in case of Myocardial Infarction females the maximum percentage was observed between 36-40 (46.67%).

On the other hand, in control males it was found to be in the range between 41-45 (40.41) and in control females it was seen between 31-35 (18.33).

On statistical analysis a small decrease in the mean value of ab ridge count was reported in Myocardial Infarction males and Myocardial Infarction (M+F), when compared with controls. On the contrary there was a small increase in mean value of ab ridge count in Myocardial Infarction females as compared to control females.

t-value was calculated for ab ridge count for comparison between total Myocardial infarction cases and control. As a result it was reported that there is statistically significant difference in the mean value of ab ridge count of both right and left hand

in Myocardial Infarction Males as well as Myocardial Infarction females as compared to controls.

Arun et al (10) reported that there is statistically significant decrease in the mean value of ab ridge count in MI males ($p<0.05$) and in right hands of (M+F) combined ($p<0.05$). The statistically significant increase is seen in MI females ($p<0.05$). But **Hemlata Dhanraj (2010)** [11] noted increase in the mean value of ab ridge count in CAD males and decrease in CAD females, CAD (M+F) and in both hands as compared to controls but not statistically significant.

M Asif and Bhat [12] reported mean value of a-b ridge count of Mi and control groups were significant ($P<0.05$).

In the **present study**, In Myocardial Infarction males, the maximum percentage of atd angle is observed in the frequency range of 36-40 as compared to control males. Whereas in Myocardial Infarction females the maximum percentage of atd angle is seen between .

atd angle:

On statistical analysis **in the present study**, it was reported that there is increase in the mean value of atd angle in Myocardial infarction males and females as compared to controls. Similarly the increase was also found in both right and left hands in Myocardial Infarction when compared between the two groups.

On comparing the t-value for atd angle , it was observed that there is statistically significant difference in mean value of atd angle in Myocardial Infarction cases ($p<0.001$) & in both Right and Left hands of total Myocardial Infarction cases ($p<0.005$). No statistically significant difference was observed in atd angle in Myocardial Infarction females.

Arun kumar (10) reported that the mean value of atd angle is increased in both sexes and in both hands with significant increase in MI males ($p<0.001$), MI (M+F) ($p<0.001$) and in both hands ($p<0.05$). **Hemlata Dhanraj (2010)** [11] noted increase in the mean value of atd angle in both sexes and in both hands as compared to controls with statistically significant increase in CAD males ($p<0.001$), CAD (M+F) ($p<0.001$) and CAD left hand ($p<0.01$) which is similar to the finding of present study. The mean value of ab ridge count in MI is 39 and in controls it is 40 and there is no significant decrease in the mean value of ab ridge count in male patients of MI, but significant decrease is observed in female patients ($p<0.05$) when compared to controls. There is significant increase in the mean value of atd angle in both hands of MI patients ($p<0.01$) and the mean value of atd angle is 41 in MI and 39 in controls. Thus from the present study, it appears that there do exist variations in the dermatoglyphic patterns in Myocardial Infarction. The specific features of dermatoglyphic patterns present in it raise the possibility of using dermatoglyphic study as a mass screening program for prevention of MI in technically deprived rural or countryside areas. It might help the healthcare workers to advise lifestyle changes for early detection and prevention of Myocardial infarction.

ACKNOWLEDGEMENT:

Here I take the opportunity to specially thank the cardiologist and staff of the private hospitals for helping me in collecting the data. I also pay my gratitude towards the participants of the study for their patience and cooperation.

AUTHOR CONTRIBUTION:

Dr. Pawan Kumar Mahato: Substantial contribution to the conception and design of the study. Final approval of the version to be published.

Reenu Kumari: Original idea and concept design for the study, acquisition, analysis and interpretation of the data. Drafting of the research article.

Dr. Nivedita Pandey: Analysis of the data and Revising the work critically for important intellectual content.

Amod kumar Yadav : Data collection and statistical analysis.

FUNDING:

None

COMPETING INTEREST:

The authors declare no competing interests. We declare that the study was conducted in absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

REFERENCES:

1. Cummins H. Dermatoglyphics stigmata in Mongolism. *Anat. Record*, 1936;64 (suppl.2):11.
2. Cummins H and Midlo. *Finger prints of palms and soles: An introduction to dermatoglyphics*. 1961; Dover pub. INC, New York.
3. Purkinjee J E (1823): *Commentatio de examines physiologico organi visus ef systematis cutanei*, Breslau (translated into English by Cummins H. And Kennedy RW) *Ad. J. Crim Law Criminol*, 1940; 31: 343-356.
4. Holt SB and Lindsten J. Dermatoglyphic anomalies in Turner's syndrome. *Ann Hum Genet London* 1964; 28: 87-100.
5. Galton F. (1892). *Fingerprints*. MacMillan, London.
6. Penrose LS. Finger prints, palms and chromosomes. *Nature*, 1963; 197:933-938
7. Lu H, Qian W, Gang Z, Sheng Y, Yu H, Ma Z et al. Dermatoglyphics in Coronary Artery Disease among Ningxia Population of North China. *J Clin Dign Res* 2015; 9 (121) ACO1
8. Vidya CS, study of dermatoglyphics pattern in patients with essential hypertension, MD thesis, 2006
9. Bala Anju, Tamang BK. A study of palmar and digital dermatoglyphics patterns of patients with diabetes mellitus with or without hypertension in a tertiary care hospital in sikkim. 2018; Phd Thesis.
10. Arun kumar KR, Delhiraj U, Dhanlaxmi V. A study on dermatoglyphics patterns of patients with myocardial infarction. *Int J Anat Res* 2021, Vol 9(4): 8160-67. ISSN 2321-4287.
11. Chimne HD, Ksheersagar DD. Dermatoglyphics patterns in angiographically proven coronary artery disease. *J Anat Soc India*. 2012; 61(2); 262-268.
12. Asif M., Bhatt S, Nizamudin S, Mustak MS. Association between Myocardial Infarction and Dermatoglyphics: A cross sectional study. *J Cardiovascular disease Res*. 2018; 9(1): 9-14.