Variation of Dermatoglyphic Pattern in Congenital Heart Disease Patients

Kimty Tasmia[1*] Dipannita Basak[2] Ashrafi Akter Zahan[3]
Moniruzzaman[4] Nadia Yesmin[2] Md. Ashrafuzzaman[5]

Abstract

Background: Congenital Heart Disease (CHD) is a prenatal heart abnormality. Dermatoglyphics, an epidermal ridge on the palmar surface of the hand, develops early in pregnancy and may be inherited or environmental. Skin and cardiac development during pregnancy are associated with congenital heart disease. Palmar dermatoglyphic patterns can be utilized as a screening test for suspected CHD patients to prevent additional complications. Thus, this study aimed analysis of CHD patients' palmar dermatoglyphic patterns.

Materials and methods: The Department of Anatomy, Chittagong Medical College, Chattogram, carried out this cross-sectional observational study on 130 pediatric cardiology patients from January 2022 to January 2023. A Chi-square test was used for statistical analysis, with a p-value of <0.05 considered significant with 95% confidence.

Results: CHD patients had significantly decreased finger arch pattern frequency compared to the control group ($p< 0.001$). CHD had more ulnar loop and whorl patterns than the control group, but the differences were not statistically significant ($p > 0.05$).

Conclusion: CHD patients have distinct palmar dermatoglyphics than non-CHD patients. Dermatoglyphic screening can detect suspected CHD patients in remote places and avoid consequences.

Key words: Atrial septal defects; Congenital heart disease; Ventricular septal disease.

Introduction

Various markers, including morphological, molecular and biochemical ones, can be used to distinguish individuality. These methods encompass anthropometric analysis and specifically dermatoglyphics.[1] Since ancient times, we have been captivated by the intricate ridge pattern found on thepalmar and plantar surface.[2] The dermatoglyphics refers to the epidermal ridge pattern found on the palmar aspect of the hand.[3] Dermatoglyphics exhibit individual variations. The development of dermatoglyphic patterns begins during the second trimester. Embryonic insults can influence individual variations in dermatoglyphic patterns.[4,5]

Congenital cardiac abnormality is a prevalent kind of congenital deformity.[6] Approximately 90% of congenital heart defects consist of Ventricular Septal Defects (VSD) Atrial Septal Defects (ASD) Patent Ductus Arteriosus (PDA) and Tetralogy Of Fallot (TOF).[7] There is a hypothesis that suggests that patients with congenital heart defects have atypical dermatoglyphic patterns.[8] The main types of dermatoglyphic patterns include whorl, loop, and arch.[3]

An investigation of the correlation between congenital heart disease and fingerprint patterns would facilitate the early diagnosis of patients with congenital heart disease. In our developing nation, the prompt and cost-effective identification of congenital heart disease is not readily accessible. However, the palmar dermatoglyphic pattern can be swiftly captured, at a low cost, and analyzed with ease. Within this particular context, the inclusion of dermatoglyphic pattern analysis can serve as a diagnostic tool to identify patients who may have congenital heart disease at an early stage, hence mitigating the risk of complications. The objective of this study was to ascertain the potential disparities in dermatoglyphic patterns between individuals with congenital heart disease and those without.

Materials and methods

After receiving ethical approval from the Chittagong Medical College Ethical Review Committee, this cross-sectional observational

1. Lecturer of Anatomy
Gonoshasthaya Samajvittik Medical College, Dhaka.
2. Post Graduate Student of Anatomy (Thesis Part)
Chittagong Medical College, Chattogram.
3. Associate Professor of Anatomy
Gonoshasthaya Samajvittik Medical College, Dhaka.
4. Registrar of Ear, Nose & Throat
Gonoshasthaya Samajvittik Medical College Hospital, Dhaka.
5. Professor of Anatomy
Chittagong Medical College, Chattogram.

***Correspondence: Dr. Kimty Tasmia**
Cell : 01768 53 27 61
E-mail: drkimtytasmia@gmail.com

Submitted on : 26.09.2023
Accepted on : 04.11.2023

study with certain analytical components was carried out at the Department of Anatomy. From August 2022 to December 2022, data were gathered in the BSMMU Department of Pediatric Cardiology to observe the dermatoglyphic patterns in patients with CHD. Thirty individuals without any congenital heart defect and one hundred patients with congestive heart failure made up the 130 responders who were chosen for this study based on inclusion and exclusion criteria. The age range for participants to meet the inclusion criteria was 6 to 18 years old, with subjects in the same age range who were not diagnosed with CHD serving as the control group. Those with deep burns, birth defects, congenital diseases or injuries resulting in hand abnormalities were excluded, as were those with persistent scars on their fingers or palms. Each subjects echocardiography was done as a screening test for differentiation of other congenital anomalies. Every demographic information, medical records were noted, and dermatoglyphic patterns were captured using an ink technique. After that, all of the data were entered, examined, and converted to percentages using computer-based SPSS software.

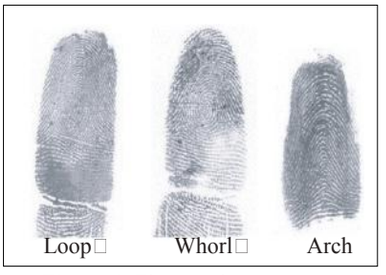

Figure 1 Finger print patterns

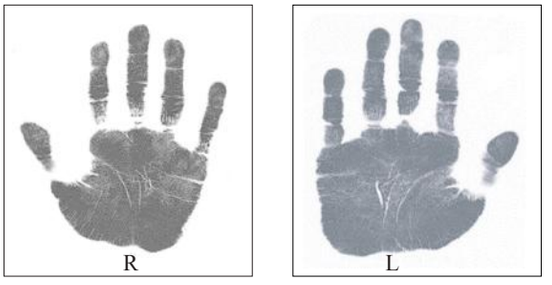

Figure 2 Right and Left Palm Print (Case)

Procedure of Taking Fingerprint

The Ink and paper method, first described by Cummins and Midlo in 1961, was used to take dermatoglyphic prints Initially, an expert. cardiologist reported an echocardiograph that was used to select confirmed kids with congenital heart disorders from the Pediatric Cardiology Department at BSMMU Each guardian provided written informed consent after being briefed about the study's nature and goals to the subjects and parents at the outset. From the subject's medical records, basic information such as name, age, and sex were noted. To get rid of grime, the person's hands were cleaned with liquid soap before being inked. A paper towel was then used to wipe the hands. A clipboard held two white sheets that were used to snap pictures of the right and left hands. The clipboard was then set up on a wooden table. A dry, clean, flat-bottomed container was filled with the necessary amount of ink. Until the ink was evenly and thinly distributed throughout the hand roller, it was moved in the ink. With the aid of the roller, both hands were painted. The inked roller was uniformly passed over the palm and digits to apply a thin layer of ink. After making sure the palms and fingers were correctly inked, the handprint was taken on the white paper that was attached to the clipboard. On the paper was the palmer aspect of the wrist. Next, from the proximal to the distal end of the paper, the palm was progressively put. Lastly, fingerprints were captured on paper after fingers were rolled from the radial to the ulnar side. In the opposite direction, from the distal to the proximal end, the palm was removed from the paper. The next instruction was to wash both hands with Turpin oil liquid soap while the faucet was running, then pat dry with a paper towel. We used magnifying glass to inspect the painted papers.

Results

When the Chi-squire test was used to analyze the dermatoglyphics pattern on the fingertips of both hands in CHD patients and the control group, the results showed that the arch pattern in the case group was lower (6.0%) than in the control group (43.3%), and this difference was statistically significant ($p<0.001$). The ulnar loop pattern values for the case and control groups were 46.0% and 26.7%, respectively. However, a Chi-squire test revealed no significant difference between the case and control groups ($p=0.094$). The case and control groups' radial loop patterns were 7.0% and 6.7%, respectively. However, a Chi-squire test

revealed no statistically significant difference between the two groups (p = 0.729). The case and control groups' whorl patterns were 41.0% and 23.3%, respectively. However, a Chi-squire test revealed no statistically significant difference between the two groups (p = 0.729).

Table I Comparison of dermatoglyphic pattern on fingertips of both hand in patients with CHD and subjects without any CHD (n=130)

Pattern of fingerprints	Subject with CHD (n=100)	Subject without CHD (n=30)	p-value
Ulnar loop	46 (46.0)	8 (26.7)	0.094
Radial loop	7 (7.0)	2 (6.7)	0.729
Whorl	41 (41.0)	7 (23.3)	0.729
Arch	6 (6.0)	13 (43.3)	<0.001

Chi-Square test was done

Discussion

The Arch pattern in the current study was 43.3% in the control group and 6% in the case. According to Table I, this difference was statistically significant (p<0.001). In the case group, the ulnar loop pattern was 46%, while in the control group, it was 26.7%. At p = 0.094, this was not statistically significant. The case group's radial loop pattern was 7%, whereas the control group's was 6.7%. At p = 0.470, this was not statistically significant. The case group's whorl pattern was 41%, whereas the control group's was 23.3%. This difference was statistically insignificant (p = 0.729). In a study conducted in India, Pushpamala et al. discovered that both the whorl pattern case and the ulnar loop pattern were statistically significant, with the whorl pattern case being lower than the control group. When it comes to ulnar loop pattern, the results of this study are almost identical to those of the current investigation, however, they differ from whorl pattern.[9] Anturlikar et al. carried out research in Maharashtra, India. The whorl loop index increased, however, it was not statistically significant. This result is consistent with what we found.[10] In an Indian study, Wanjari et al. found that patients with congenital heart disease had the highest incidence of the ulnar loop pattern; this conclusion was almost identical to the current investigation.[11] In New Delhi, India, Brijendra et al. conducted a study. This study revealed a statistically significant increase in whorl pattern in CHD patients as compared to the control group. This study's findings are almost identical to this one.[12] In a study conducted in Manchester, UK, in 1980, Devid discovered that CHD patients had more arches than the control group, this current study's findings differ from Devid's.[13] Goto et al. conducted a study in Kyoto, Japan, and found that CHD patients had higher whorl and loop patterns than the control group.[14] In a study conducted in Louisiana, USA, Hale et al. found that the fingerprint patterns of the group of CHD patients did not significantly change. This study's findings differ from this one.[15]

Limitations

The results of this study may not be entirely representative of all individuals with congenital cardiac disease because it was undertaken in a limited number of hospitals over a brief period of time. Due to the manual inking method used in the study, there may have been a small number of mistakes.

Conclusion

The results of this investigation indicate that patients with CHD had a considerable reduction in arch pattern frequency. Although not significantly different from the control group, the frequency of the ulnar loop and the whorl pattern of the fingertips were higher in CHD patients.

Recommendations

Corresponding larger numbers of samples from various regions can be used in studies, and the results of this research must be confirmed. More research can be done using modern methods, like a biometric scan machine, to increase the dependability of the dermatoglyphic pattern.

Acknowledgement

We sincerely thank all the responses, the personnel of BSMMU, and the instructors and staff of the Anatomy Department at Chittagong Medical College for their assistance and participation.

Contribution of authors

KT-Design, data collection, data analysis, manuscript writing & final approval.
DB- Data collection, drafting & final approval.
AAZ-Interpretation of data, critical revision & final approval.
MZ-Interpretation of data, critical revision & final approval.
NY- Interpretation of data, critical revision & final approval.
MA-Conception, critical revision & final approval.

Disclosure

All the authors declared no conflicts of interest.

References

1. Crawford MH, Duggirala R. Digital dermatoglyphic patterns of Eskimo and Amerindian populations: Relationships between geographic, dermatoglyphic, genetic and linguistic distances. Human biology. 1992; 64(5): 683-704.

2. Standring S. Skin and its appendages, John A Mcgrath, Joey Edward Lai-Cheong, Gray's Anatomy, The Anatomical Basis of clinical Practice, 42nd ed, New York, Elsevier. 2021; 162.

3. Shahani MY, Shahani SB, Bano U, Kumar G, Ali A, Zardari MU. Palmar Dermatoglyphic Patterns in Normal and Congenital Heart Diseased Children. Pakistan Journal of Medical & Health Science. 2021 ;15(2): 917-919.

4. Birnholz JC. Dermatoglyphics in congenital heart disease. American Journal of Roentgenology. 1972;116(3):539-547.

5. Bhat GM, Mukhdoomi MA, Shah BA, Ittoo MS. Dermatoglyphics: in health and disease-A review. Int J Res Med Sci. 2014;2(1):31-37.

6. Penman DI, Ralston HS, Strachan WZM, Hobson PR. Cardiology, DE Newby, NR Grubb, Davidson's Principles and Practice of Medicine, 24th ed, Edinburgh, Elsevier. 2023; 386.

7. Hamash A. Pattern of congenital heart disease a hospital-based study. Al-Kindy College Medical Journal. 2006; 3 (1): 44-48.

8. Milton A, Schulenberg R. Dermatoglyphics in Congenital Heart Disease. Journal of American Heart Association. 1970; 41(1):49-54.

9. Pushpamala N, Ramadevi A. Dermatoglyphics in congenital heart diseases in children. IOSR J Dental Med Sci. 2018; 17(9): 19-22.

10. Anturlikar S, Nandanvankar D, Bhusari P. A Quantitative Study of Palmar Dermatoglyphics in Congenital Heart Diseases. Indian Journal of Anatomy. 2018; 7(4): 424-429.

11. Wanjeri A, Pise ND. Study of Palmar Dermatoglyphics in Congenital Heart Disease. Journal of Evidence-Based Medicine and Healthcare. 2014; 1(8): 978-986.

12. Brijendra D, Renu G, Dushyant A, Rajneesh G, Sunil K. Dermatoglyphics in Congenital Heart Disease. Acta Medica Iranica. 2014; 54(2): 119-123.

13. Devid TJ. Dermatoglyphs in congenital heart disease. Journal of Medical Genetics. 1981; 18: 344-349.

14. Goto M, Onouchi Z, Tomisawa M, Nakata K, Goto M, Kusunoki T. QUANTATIVE ANALYSIS OF DERMATOGLYPHICS Patients with Congenital Heart Disease, and Their Parents. Japanese Circulation Journal. 1978; 43: 9-13.

15. Hale RA, Phillips HJ, Burch EG. Features of Palmar Dermatoglyphics in Congenital Heart Disease A Report on the Variants Frequently Associated with Congenital Lesions of the Heart. Clinical Science journal. 1961; 176(1): 125-129.