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Original Research Article

Study of fingerprints in children under 15 years of age with acute lymphoblastic leukaemia

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ABSTRACT

Background: Acute Lymphoblastic leukaemia is a malignant condition resulting due to continuous clonally proliferation of progenitors of lymphoid cells. The objective is to identify the association between dermatoglyphics and acute lymphoblastic leukaemia and to assess the value of dermatoglyphics as a screening tool.
Methods: A case-control study was conducted on a total of around 60 subjects below the age of 15, out of which 30 children were already diagnosed and suffering from Acute Lymphoblastic Leukaemia and the other 30 were age and sex matched controls. Fingerprints of 30 affected children were taken through an ink-pad method in both hands, analyzed and compared with controls. Information regarding any significant familial history was obtained.
Results: The study suggested with an increased rate of incidence among children of age group 3-4 years and with a male preponderance (63.3%).The findings were found to be statistically significant with an association between whorls and loops among cases and controls with higher frequency of whorls in cases and loops in controls (p value < 0.05), whereas association between whorls, arches and loops, arches was not significant. In quantitative analysis, most of the cases (n=12, 39.6%) had a PII in the range of 16-20 whereas most of the controls (n=22, 72.6%) had it in the range of 11-15, with significant overlapping.
Conclusions: The findings are suggestive of association of fingerprint pattern with the patients suffering from Acute Lymphoblastic Leukaemia and therefore they might help in early diagnosis of the condition in high risk children and thus can be helpful as a screening tool.

Keywords: Acute lymphoblastic leukaemia, Dermatoglyphics, Screening tool

INTRODUCTION

Acute lymphoblastic leukaemia is a malignant condition resulting due to continuous clonal proliferation of progenitors of both B and T lymphoid cells. It is one of the most common malignant disease usually affecting children under 15 years of age with a prevalence of about 3-4 cases per 1,00,000 children, accounting for approximately 30% of all childhood malignancies.[1] Dermatoglyphics is the study of patterns formed by epidermal ridges on fingers, palms and soles. The relationship of use of study of fingerprints in respect to various medical disorders has been in use from many years.[2,3]

The characteristics of dermatoglyphics develop between the 10th and 17th week post conception and thus they reflect the events occurring during second trimester.[4] There were certain changes observed in dermatoglyphic patterns which have prompted researchers to search for dermatoglyphic markers which help in early diagnosis of the disease. The fingerprints have been used in many

studies and are highly independent. Finger patterns are of three types i.e. arch with no triradius, loop with one triradius and a whorl with two triradii.[5]

Therefore, one of the main criteria for conducting a research on this topic is to identify the relationship between use of dermatoglyphics as a screening tool and the patients suffering from acute lymphoblastic leukaemia.[6]

METHODS

A case-control study, June 2016 to September 2016 which includes hospital visits, preliminary survey, data collection analysis and report writing. A total of around 60 subjects were included in the study, out of which 30 children were already diagnosed and suffering from Acute Lymphoblastic Leukaemia and the other 30 were the age and sex matched controls.

Inclusion criteria

- Patients under the age of 15 years with a willing consent to take part in the study will be included.
- Children of appropriate age and sex will be included in the control group.

Exclusion criteria

- Patients who are not willing to take part as well as those whose parents have not given consent will be excluded from the study.
- Patients who are suffering from severe complications of leukaemia will also be excluded from this study.

Patients suffering from acute lymphoblastic leukaemia below the age of 15years attending to Indo-American Cancer Institute and Little stars children hospital, Hyderabad will be included in the study along with appropriate age and sex matched controls. Clearance was obtained from the Ethical Committee at the institute to carry out the study in the proposed manner. A written informed consent was taken from each patient before enrollment of each subject in the study.

A semi structured questionnaire was used to collect the basic details from the subjects like age, gender, past and familial history. Each child was asked to clean their hands and wash it with soap and water.

Prints of fingers were taken by a blue inkpad method on a paper by asking the children to roll their finger bulbs on a paper. Patterns of fingerprints were assessed with the help of a magnifying lens. Percentage frequency of arch, loop and whorl pattern and atd angle (Axial triradius) were calculated in both patients of acute lymphoblastic leukaemia and control group. Pattern intensity index of each individual was calculated for quantitative analysis. Data was entered in MS Excel and was analyzed using SPSS (Statistical Package for the Social Sciences).

RESULTS

A total of about 18 children (30%) of age 4 years, 12 children (20%) of age 3 years, 8 children (13.3%) of age 2 years, 6 children (10%) of age 5 years, 4 children (6.7%) of age 7 years, 4 children (6.7%) of age 9 years, 2 children (3.3%) each of ages 8 years, 10 years, 11 years were included as subjects (Figure 1).

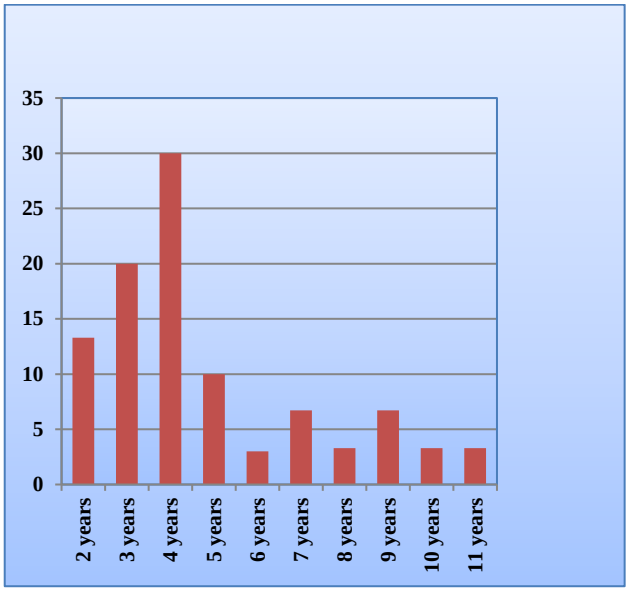

Figure 1: Distribution of subjects based on age.

A total of about 38 male children (63.3%) and 22 female children (36.7%) were included in the study which shows a significant incidence among male children than female children (Table 1).

Table 1: Distribution of subjects based on sex.

Sex	Number of children
Male	38 (63.3%)
Female	22 (36.7%)
Total	60 (100%)

There is an evidence of increased frequency of loops (167) in controls than cases (130) whereas increased frequency of whorls was noted in cases (151) when compared to controls (114). Loop to whorl ratio was quite not significant in cases (1:1.16) whereas in controls the ratio was (1:0.68).

There is no significant difference in respect to arches among cases and controls (Table 2). Whorls were significantly higher in cases among all the digits except in the ring finger, where whorls in both cases and controls were in the ratio of 1:0.9.

Table 2: Distribution of fingerprints among study subjects.

Pattern	Loops		Whorls		Arches	
Digit	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**
Thumb	26	35	29	21	5	4
Index finger	20	39	34	18	6	3
Middle finger	30	35	28	21	2	4
Ring finger	21	22	36	34	3	4
Little finger	33	36	24	20	3	4
Total	130	167	151	114	19	19

Loops in controls were significantly higher in index finger when compared to other digits. A total number of 151 whorls and 130 loops were found among the fingerprints of cases whereas a total number of 114 whorls and 167 loops were found among the controls (Table 3).

Table 3: Association of whorl and loop pattern among cases and controls.

Pattern	Cases	Controls	Odds ratio
Whorls	151	114	1.7016
Loops	130	167	

The findings were found to be statistically significant (P=0.0018, P<0.05) with an odds ratio of 1.7016 (95% CI=1.2-2.3). A total number of 151 whorls and 19 arches were found among the cases whereas a total number of 114 whorls and 19 arches were found among controls. The findings were not found to be statistically significant (P>0.05) (Table 4).

Table 4: Association between whorl and arch among cases and controls.

Pattern	Cases	Controls	Odds ratio
Whorls	151	114	1.3246
Arches	19	19	

A total number of 131 loops and 19 arches were found among cases whereas a total number of 167 loops and 19 arches were found among controls. The findings were not found to be statistically significant (P>0.05) (Table 5). On quantitative analysis of fingerprint patterns, mean value of PII was found to be higher in cases than controls (Mean=13.8 in cases and Mean=12.6 in controls). The standard deviation was found to be 3.5 and 2.7 in cases and controls respectively (Table 6).

Table 5: Association between loops and arches among cases and controls.

Pattern	Cases	Controls	Odds ratio
Loops	130	167	0.7784
Arches	19	19	

Pattern Intensity Index (PII) was calculated for both cases and controls. PII is calculated by scoring 2 for each whorl pattern, 1 for each loop pattern and 0 for each arch pattern.

Table 6: Mean and standard deviation of PII among cases and controls.

	Range	Mean	SD
Cases (n=30)	0-20	13.8	3.5
Controls (n=30)	0-20	12.6	2.7

Most of the cases (n=12, 39.6%) had a PII in the range of 16-20 whereas most of the controls (n=22,72.6%) had it in the range of 11-15, with significant overlapping (Figure 2).

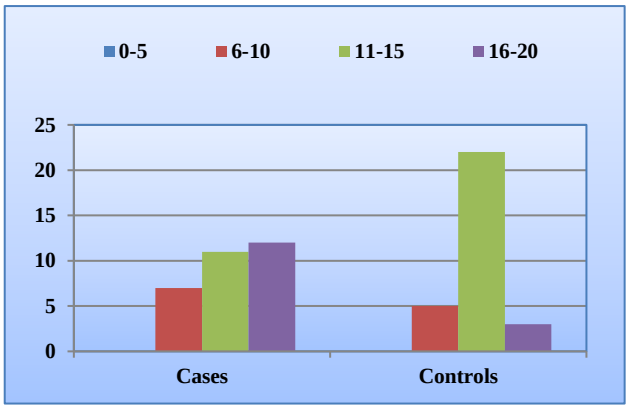

Figure 2: Pattern Intensity Index among cases and controls.

DISCUSSION

A total of 60 subjects out of which 30 children were already diagnosed and suffering from ALL and 30 controls (age and sex matched) of age below 15 years were included in this study and their fingerprints were taken.

Semi-structured questionnaires were given to the subjects through which basic information like age, gender, past history, familial history were studied.

Demographic data

In the present study among the 60 subjects who were included in the study, 30% children were of age 4 years, 20% were of 3 years, 13.3% were of 2 years, 6.7% of ages 7 and 9 years, 3.3% of ages 8,10 and 11 years. This is in agreement with a study done by Pieters R et al in Denmark in which 72% children were in the age group of 1.5-10 years.[7] In this study of 60 subjects, 63.3% were male children and 36.7% were female children. This finding are consistent to that of a study done by Dores GM et al in United States which suggested with a twice the incidence of ALL in males than females.[8]

Distribution of fingerprint pattern among the subjects

In this present study, about 50.3% of whorl pattern was noted in cases and in controls whorl pattern constituted to about 38%. In case of loops, about 55.7% was noted in controls whereas it was about 44.3% in cases. In case of arches, percentage was noted to be around 6.3% in both cases and controls. Thus, it indicated an increase in frequency of whorls and decreased frequency of loops among cases than controls.

These findings were similar to that of a study done by Verbov JL in London which suggested with an evidence of about 41.9% and 27.2% of whorl pattern among male cases and controls respectively. In case of loops, about 62.6% was noted in controls whereas it suggested with a percentage of about 49.7% among cases. In case of arches, it was about 5% and 5.3% in cases and controls respectively.[9] In another study conducted by Bukelo MJ et al in Mangalore, whorl percentage was about 46.6% and 32% in cases and controls respectively whereas loop percentage was 46.6% and 61.6% in cases and controls respectively. Arch percentage was about 6.6% and 6.25%in cases and controls respectively.[10]

Association of whorl and loop pattern among cases and controls

In this study, the subjects who had higher number of whorl patterns were children who are positive for ALL and loops were higher in controls. The findings for association were found to be statistically significant ($P<0.05$) with children who have higher frequency of whorl pattern at 1.7 (95% CI = 1.2-2.3) times higher risk of having Acute Lymphoblastic leukaemia when compared to those with of higher frequency of loop pattern. This is in accordance with a study conducted by Purvis-Smith SG et al in Britain which suggested with significant association of increased frequency of whorls in both male ($P<0.01$) and female ($P<0.025$) patients.[11]

Association of whorl and arch pattern among cases and controls

In the present study, there is an increased frequency of whorls among cases than in controls whereas the frequency of arches was same, about 6.3% in both cases and controls. The findings for association were not found to be statistically significant ($P>0.05$), but it is suggestive of the finding that children with higher frequency of whorl pattern are at 1.3 times higher risk of having Acute Lymphoblastic Leukaemia when compared to subjects with predominant arch pattern.

There was no significant statistical association which was found between whorls and arches from the previous studies conducted by Verbov JL in London and Purvis-Smith SG et al in Britain.[9,11]

Association of loop and arch among cases and controls

In the present study, the findings for association were not found to be statistically significant ($P>0.05$) with respect to loops and arches among cases and controls.

Pattern intensity index among cases and controls

According to this study, PII was in the range of 11-15 for about 72.6% of controls whereas PII in the range of 16-20 was found in most number of cases about 39.6%.This is in acceptance with the studies conducted by Purvis-Smith SG et al in Britain and Bukelo MJ et al in Mangalore which are suggestive of higher PII among cases than controls.[10,11] In the present study, mean PII was higher in cases (13.8) when compared to controls (12.6). This is in accordance with a study conducted by Bukelo MJ et al in Mangalore which suggested of higher mean PII in cases (14.00) when compared to controls (12.58).[10]

CONCLUSION

The findings are suggestive of increased incidence of leukaemias among males. Increase in frequency of whorls and decreased frequency of loops among cases than controls. Application of knowledge of forensic medicine can be applied in diagnostic criteria. Assessment of fingerprint patterns can help in early diagnosis of patients with Acute Lymphoblastic Leukaemia.

By establishing an association between patterns and fingerprints a relationship can be obtained from leukemogenesis and embryonic development, as the ridges start developing during the foetal life. Only the fingerprints cannot be considered for diagnostic purposes, but they can be used as a screening tool.

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