Fingerprint and Palmar Patterns in Fanconi Anemia*

M. Hakan Polat[1]

*This study has been reported on Fourth Congress of European Haematology Association,
[1]Istanbul University, Istanbul Faculty of Medicine, Department of Internal Diseases, Istanbul, Turkey.

Fanconi Anemide Parmak İzi ve Avuç İçi Örnekleri

Özet

11'i erkek, 18 Fankoni anemi (FA) olan hastanın parmak ve avuç içlerindeki dermatoglifik örnekler incelendi. Parmak ve avuç içi örneklerinin analizi bir büyüteç ve bir stereoskopik mikroskop yardımı ile yapıldı.

FA olan hastaların el parmak uçlarında ulnar ilmekler ve total parmak çizgi sayısı fazla, düğüm tipleri ve erkeklerin sol ellerinde atd açısı azdır. Hastaların el ayalarında II ilmeği ve t triradiusu fazla, IV ilmekleri ve t' triradiusları azdır. Ayrıca, A temel çizgisinin 5' noktasında sonlanma sıklığı kontrollerden daha fazladır. Hastaların a-b çizgi sayılarında önemli bir fark yoktur.

Sonuç olarak, FA olan hastaların parmak ve avuç içlerindeki dermatoglifik örneklerde önemli farklar vardır. Bu bulgular FA'nın diğer klinik özellikleri ile birleştirildiği zaman hastalığın tanısında yardımcı olabilir.

Anahtar Kelimeler: *Fankoni anemi, dermatoglifikler, kalıtım.*

Abstract

With the aim to examine the dermatoglyphic patterns of finger and palm, 18 Fanconi anemia (FA), 11 being male were studied. Analysis of fingerprint patterns was realized with a magnifier and a stereoscopic microscope.

On the fingertips of FA, ulnar loops and total finger ridge count (TFRC) are more, whorl types, atd angles on left hand of males are less, and II. loops and t triradii are more, IV. loops and t' triradii less than those of the control cases. Furthermore, the frequency of the ending of the main line A of FA patients in 5' was more than controls. There is no significant difference in a-b ridge counts the subjects with FA and that of the controls.

In conclusion, the dermatoglyphic patterns of finger and palm was significantly different in patients with FA. When combined with other clinical features in FA can serve to strengthen a diagnostic impression.

Key Words: *Fanconi anemia, dermatoglyphics, heredity.*

Although fingerprints and handprints are widely used in criminology, diagnostic application in medicine is now more frequent (1-3). Dermatoglyphic patterns stay constant during life and may sometimes play a significant role in the diagnosis of many disorders with genetic background (4). Dermatoglyphic patterns have been previously studied in disorders such as chromosomal diseases (5), cardiac diseases, duodenal ulcer, leukemias, biliary atresia, rheumatoid arthritis and dermatitis herpetiformis (3,6-12). It was even described an association between dermatoglyphic patterns and sudden infant death syndrome (13).

This autosomal recessive disorder is associated with upper limp abnormalities involving the radius and thumb, increased pigmentation and a failure of the bone morrow leading to deficiency of all types of blood cells, e. g. pancytopenia (14).

Dermatoglyphics are assumed to be genetically controlled, although the exact mechanism of inheritance is still unknown. The utility of dermatoglyphics in medicine has been demonstrated by a number of investigators (15-17). This is the first dermatoglyphic study conducted on Turkish population involving patients with FA. The purpose of this report was to determine the usefulness of dermatoglyphics in studying the genetic etiology of FA.

Materials and Methods

This study is based on 11 male and 7 female summing up to 18 patients who have been diagnosed as FA during 1994-1998 at Istanbul University, Our-Children Leukemia Foundation Health Center. The control group is composed of 42 male and 38 female, a total of 80 cases.

The fingertips and palmar prints were obtained using ink and pad technique as described by Cummins and Midlo (18). Ether was used in every case to clear the finger and the palm and to remove the sweat. After rolling the black ink on a simple glass, the first fingertips and further the palm prints were recorded on a paper of the quality and were performed by a specialist (Polat MH) who also taken all prints. Analysis of fingerprints patterns was realized with a magnifier and a stereoscopic microscope.

Fingerprint patterns, total finger ridge count (TFRC), palmar a-b ridge count, atd angles, main line terminations were assessed with classic method (18), the palmar patterns with the topologic method (19). All data has been evaluated using chi-square and student's t test.

Results

The frequency of fingerprint patterns in Fanconi patients is given in Table 1. The fingertips of the patients with FA demonstrated an increase in frequency of ulnar loops and a decrease in frequency of whorls when compared with controls ($p<0.05$, $p<0.01$).

The means and standard deviations are shown in Table 2. TFRC's of male and female in patients with FA were higher than controls ($p<0.05$). The angle atd showed a decrease on left hand of males with FA that of the controls ($p<0.05$). There was no significant difference in palmar a-b ridge counts between patients and controls ($p>0.05$).

Palmar dermatoglyphic patterns of FA and control cases are shown in Table 3. At the volar surface of the hand of the patients with FA palmar II loops and t triradii are significantly more than controls ($p<0.05$). Whereas, palmar IV loops and t′ triradii are significantly less ($p<0.05$).

The main line terminations of FA and control cases were shown in Table 4. The frequency of the ending of the main A line of patients with FA in a specific sector 5′ was more than controls ($p<0.05$).

Characteristic dermatoglyphic patterns in Fanconi anemia patients are shown in Figure 1.

Table 1. Frequency of fingerprint patterns in Fanconi patients and controls.

	Fanconi Anemia		Controls	
Fingertip Patterns	Male (n=11)	Female (n=7)	Male (n=42)	Female (n=38)
Arch	1.8	4.3	1.2	6.8
Ulnar loop 6	7.3*	74.3**	55.9	56.1
Radial loop	4.5	2.9	5.5	4.2
Whorl	26.4*	18.6*	37.4	32.9

* Difference significant at $p<0.05$
** Difference significant at $p<0.01$

Table 2. Mean and Standard Deviations (S. D) of quantitative parameters of Fanconi anemia patients and controls.

Parameters	Subjects	MALES		FEMALES	
		N	Mean ± SD	N	Mean ± SD
TRC	Fanconi anemia	11	149.45± 10.48*	7	145.21 ±23.48*
	Controls	42	126.96± 34.69	38	108.53 ±42.79
a-b ridge count	Fanconi anemia	11	77.18± 9.29	7	72.29± 11.92
	Controls	42	76.07± 11.89	38	74.69± 7.28
atd angle values	LEFT HAND				
	Fanconi anemia	11	41.36± 5.73*	7	49.57± 11.41
	Controls	42	48.64±10.88	38	51.97± 10.21
	RIGHT HAND				
	Fanconi anemia	11	51.09±15.84	7	47.43±12.38
	Controls	42	51.52±11.41	38	52.50±11.69

* Difference significant at $p<0.05$

Discussion

Dermatoglyphic patterns appear at third week of gestation, are formed completely at the 19th week, and showed no change during life expect in size (20). In certain chromosomal abnormalities

such as Down's, Turner and Klinefelter's syndromes (21-24) and certain syndromes which show hereditary hand defects such as Rubinstein Taybi (25), genetic factors play an important role in formation of dermatoglyphic patterns. Nongenetic factors such as teratogenic substances e. g. thalidomide and viral infections influence also their formation (26-27).

Table 3. Palmar dermatoglyphic patterns of Fanconi patients and that of control groups.

Loops	Fanconi anemia (n: 18)	Controls (n: 80)
I	5.6	3.1
I^r	8.3	5.0
II	13.9*	3.1
III	44.4	43.8
III^T	8.3	7.5
IV	25.0*	45.6
IV^u	0.0	0.0
H	19.4	17.5
H	16.7	24.4
H^r	2.8	2.5
Triradii		
e	2.8	4.4
f	0.0	1.9
t	80.6*	60.0
t′	13.9*	33.8
t″	16.7	23.1
t^b	8.3	15.6

* Difference significant at $p<0.05$

Table 4. The termination places of palmar A-lines of Fanconi patients and controls.

Termination Places	Fanconi Anemia (n: 18)	Controls (n: 80)
1	5.6	5.0
3	22.2	28.1
4	13.9	23.8
5′	55.6*	35.6
5″	0.0	4.4
11	2.7	3.1

* Difference significant at $p<0.05$

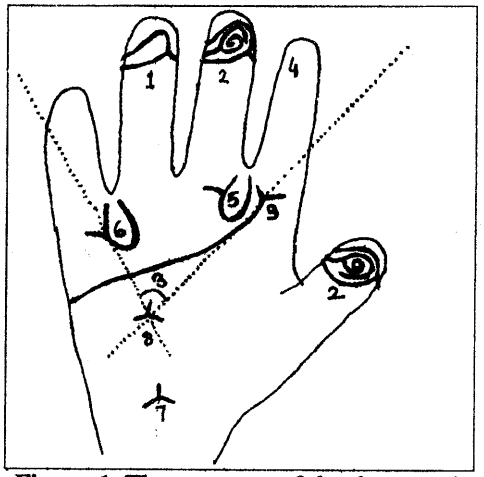

Figure 1. The summary of the dermatoglyphic findings of Fanconi anemia patients.

1-Increased frequency of ulnar loops on the finger-tips.
2-Decreased frequency of whorl types on the finger-tips.
3-Less atd angles on the left hand of males.
4-More TFRC on the fingertips of males.
5-More II loops on the palms.
6-Less IV loops on the palms.
7-More t triradii on the palms.
8-Less t′ triradii on the palms.
9-More frequently in sector 5′ of palmar A-lines on the palms.

During the last several years various have considered between dermatoglyphics and neoplasias (28-30). Many studies have focused on lymphocytic leukemia, often with conflicting results. Wertelechi et al (31) determined that male leukemics had a higher frequency of both digital whorls and Sydney lines than normals. Verbov (32), on the other hand while finding a higher frequency of whorls among leukemics, found no significant increase in the increase of Simian and Sydney lines. Colombo et al (33) found an increase in Sydney lines in male patients with leukemia. Polat (30) observed that there was an increase in H loops, Sydney lines in male leukemics and a decrease in a-b ridge counts and atd angles in patients with Lymphocytic leukemia. Polat (30) supported Colombo's and Wertelechi's finding of a higher frequency of Sydney lines among male leukemics.

The results of our work with patients suffering from FA suggest that there are dermatoglyphic differences between these patients and normals. On the fingertips of FA, ulnar loops and TFRC are more, whorl type patterns, atd angles on left hand of males are less, and palmar II loops and t triradii are more, palmar IV loops and t′ triradii are less than those of the control cases. Also, palmar A lines on the palm were opening toward 5′ the region. We did not observe any difference with palmar a-b ridge count in patients group.

As a result, according to these findings, there is a relationship between FA and dermatoglyphics that known as genetic. A correlation that is statistically significant has been determined. However, when combined with other clinical features of FA, dermatoglyphics can serve to strengthen a diagnostic impression. Further large-scale studies are needed to confirm the dermatoglyphics in this preliminary report. We believe that these results can help other studies for the dermatoglyphic patterns on fingerprints and palms

References

1-Ziegler AG, Mathies R, Ziegelmayer G, et al. Dermatoglyphics in type 1 diabetes mellitus. Diabet Med 1993; 10: 720-4.

2-Rajangam S, Janakiram S, Thomas IM. Dermatoglyphics in Down's syndrome. J Indian Med Assoc 1995; 93: 10-3.

3-Chiba T, Ishimaru Y, Taguchi S. Dermatoglyphic (fingerprint) pattern in biliary atresia. Eur J Pediatr Surg 1995; 5: 82-3.

4-Alter M. Dermatoglyphic analysis as a diagnostic tool. Medicine 1967; 46: 35-6.

5-Perus M, Fraser FC. Dermatoglyphics and syndromes. Am J Dis Child 1972; 124: 933-43.

6-Swartz MH, Herman MV, Teicholz LE. Dermatoglyphic patterns in patients with mitral valve prolapse: a clue to pathogenesis. Am J Cardiol 1976; 38: 588-93.

7-D'Onofrio F, Passariello N, Sepe J, et al. A clinical, genetic and echocardiographic study of hypertrophic cardiomyopathy in a large family. Eur J Med 1993; 2: 227-31.

8-Habibullah CM, Mujahid Ali M, Shivaprakash M, Iqbal MA, Ishaq M. Fingerprint and palmar patterns in duodenal ulcer. Hum Hered 1982; 32: 432-4.

9-Menser MA, Purvis-Smith SG. Dermatoglyphic defect in children with leukemia. Lancet 1969; 1: 1076-8.

10-Jones L, Thein SL, Jeffrerys AL, et al. Identical twin narrow transplantation for 5 patients with chronic myeloid leukemia: rote of DNA fingerprinting to confirm monozygosity in 3 cases. Eur J Haematol 1987; 39: 144-7.

11-Taneja V, Taneja N, Anand C, Mehra NK. Dermatoglyphic patterns of patients with rheumatoid arthritis. Indian J Med Res 1993; 98: 143-6.

12-Verbov J, Kumar PJ, Marks R. Fingerprint changes in dermatitis herpetiformis. Br Med J 1971; 4: 300-1.

13-Kozakewich H, Fox K, Plato CC, Cronk C, Mandell F, Vawter GF. Dermatoglyphics in sudden infant death syndrome. Pediatr Pathol 1992; 12: 637-51.

14-Mueller RF, Young ID. Emery's Elements of Medical Genetics. 10th ed. London: Churchill Livingstone, 1998; 245-264.

15-Schaumann B, Alter M. Dermatoglyphics in medical disorder. New York: Springer-Verlag, 1976.

16-Balgir RS. Dermatoglyphic studies in affective disorders: an appraisal. Biol Psychiatry 1982; 17: 69-82.

17-Polat MH. Tıpta dermatoglifiklerin kullanımı ve hastalıkların teşhisinde önemi. Karadeniz Tıp Derg, 1998; 11: 83-86.

18-Cummins H, Midlo C. Fingerprints, palm and soles. New York: Dower Publ. 1961; 56-74.

19-Penrose LS, Loesch D. Topologic classification of palmar dermatoglyphics. J Ment Defic Res 1970; 14: 111-120.

20-Mulvihill JJ, Smith DW. The genesis of dermatoglyphics. J Pediatr 1969; 75: 579-89.

21-Reed TE, Borgaonkar DS, Cooneally PM. Dermatoglyphic nomogram for the diagnosis of Down's syndrome. J Pediatr 1970; 77: 1024-32.

22-Lu KH. An information and discriminant analysis of finger print pattern pertaining to identification. Amer J Hum Genet 1968; 20: 24-43.

23-Hold SB, Lindsten J. Dermatoglyphic anomalies in Turner's syndrome. Ann Hum Genet 1964; 28: 87-100.

24-Nora JJ, Fraser FC. Medical Genetics: Principles and Practice. Philadelphia: Lea Febiger Co. 1974. p: 287.

25-Shiono H, Minami R, Shinoda M, Nakao T. Dermatoglyphics in Rubinstein Taybi syndrome. Tohoku J Exp Med 1971; 104: 19-24.

26-Nora JJ, Knapp HK. Thalidomide ambryopathy. Deutsch Med W Schr 1962: 87: 1232-42.

27-Achs R, Harper RG, Siegel M. Unusual dermatoglyphic findings associated with rubella embryopathy. N Eng J Med 1966; 274: 148-50.

28-Singh D. dermatoglyphic study in breast carcinoma. Indian J Pathol Microbiol, 1979; 22: 27-29.

29-Purvis-Smith SG, Menser MA. Dermatoglyphics in children with acute leukemia. Brit Med J, 1973; 4: 646-649.

30-Polat MH: Akut lenfoblastik lösemili çocuklarda dermatoglifik bulgular. Karadeniz Tıp Derg, 1997; 10: 61-64.

31-Wertelechi W, Plato CC, Fraumeni JF, Niswander JD. Dermatoglyphics in Leukaemia. Lancet, 1969; 10: 806.

32-Verbov J. Dermatoglyphics in leukaemia. J Med Genet, 1970; 7: 125-127.

33-Colombo A, Gasparoni MC, Biscotti G, Severi F. Dermatoglifi e leucemia linfatica acuta nell'infanzia. Min Ped, 1973; 25: 353-356.

Corresponding Address:
M. Hakan POLAT
Taya Kadın Sok.
Füze Apt No: 29/7
Selimiye
81170 Istanbul/TURKEY
Phone: (90) 216 4176210
(90) 212 5884800/2249