DIGITAL DERMATOGLYPHIC CHARACTERISTICS IN PATIENTS WITH SEX HORMONES ANOMALIES

Rakad M. Kh. Al-Jumaily[*], Fadhel M. Lafta[*], Lamees Kh.I. Al-Dahiri[*] and Laith Z.Fadhil[*]

[*]Department of Biology, Collage of Science, University of Baghdad.

Abstract

Background : Dermatoglyphics are the dermal ridge configurations on digits ,palms and soles. Dermatoglyphic polymorphism results from the interaction of genetic and environmental factors. The dermatoglyphic analysis is a valuable completion of initial diagnosis of some syndromes and diseases that are genetically determined. Our objective was to assess the relationship between digital dermatoglyphic patterns and sex hormones anomalies.

Methods : Dermatoglyphic pattern type frequencies (qualitative analysis), total and absolute ridge counts (quantitative analysis)and left /right asymmetry were assessed for 54 males with sex hormones anomalies and 55 controls .

Results : Dermatoglyphics pattern type frequencies were altered in patients with sex hormones anomalies versus controls . In particular, there was an increase and decrease of whorls (38.2% vs. 33.5%) and ulnar loops (51.7% vs. 58.5%) respectively. The differences were significant ($\chi 2 = 10.335$; D.F. = 3 ; $P \leq 0.05$) .In quantitative analysis , patients showed a higher mean ridges count than controls in both; the TRC (159.81 ± 5.46 vs. 144.61 ± 5.84) and ARC (213.72 ± 11.19 vs. 187.96 ± 11.07) respectively ,and a significant difference was observed in TRC analysis ($t = 1.899$; d.f. = 107 ; $p = 0.06$). Among patients with sex hormones anomalies 44.44% of them had a higher ridge counts on the left hand than on right hand versus 38% in controls .

Conclusion: Our results supported the hypothesis that prenatal sex hormones levels may have a significant effect on the development of dermatoglyphics.

Keywords : dermatoglyphics ,sex hormones anomalies.

Introduction

Dermatoglyphics are the dermal rigde configurations of digits , palm and sole (1). The dermal ridges develop in relation to the volar pads, which are formed by the 6th week of gestation and reach a maximum size between 12 and 13 weeks. This means that genetic message contained in the genome (normal – or abnormal) is deciphered during this period is also reflected by dermatoglyphics (2). Since dermatoglyphic traits reflect prenatal development, dermatoglyphic studies have also become part of medical genetics (3).

Dermatoglyphic traits are formed under genetic control early in development but may be affected by the environmental factors (such as : viral infection, radiation, alcohol and drug abuse) during the first trimester of pregnancy (4,5). The dermal patterns once formed remain constant throughout life (6) .Since dermatoglyphic alterations point toward disruption of fetal development, the report by Menser and Purvis-Simth pointing out that dermatoglyphic alterations were present in childhood leukemia was quite provocative as leukemia was consider to be a postnatal event . These patterns may represent the genetic makeup of individual and therefore his/her predisposition to certain diseases. Furthermore, dermatoglyphics serves as a window of congenital abnormalities and is a sensitive indicator of intrauterine anomalies (7, 8). The importance of these markings to the geneticist not realized until recent years , they have to be helpful adjunct to other diagnostic method in identifying specific syndromes of a genetic origin (9) .

Dermatoglyphics analysis is now a valuable companion to other methods used to detect some genetic diseases. They are considered as markers in single gene disorder: (sickle-cell anemia; 10), phenyloketonuria; 11), chromosomal abnormality : (Down, Turner and Klinefilter syndromes;12), and multifactorial conditions : (rheumatoid arthritis; 13) and

cancers;14). Since both dermal ridge and brain are derived from the ectoderm, it seams reasonable to use unusual dermatoglyphic patterns to characterize disturbances to brain development in schizophrenic and epilepsy patients (15). Furthermore ,dermatoglyphics are polygenic markers that are useful in studying population dynamic and gender dimorphism (16,17).

It has been suggested that human dermatoglyphics and brain asymmetry are influenced by prenatal hormone level (18). Higher testosterone levels in adult men were associated with more pronounced dermatoglyphics asymmetry (19). In order to measure dermatoglyphic asymmetry , finger ridge counts of both hands are compared . Although the majority of both sexes showed higher finger ridge count on the right hand than the left , a higher percentage of left asymmetry was found in women than in men (20). Studies emphasize that genetic factors affect directional asymmetry. furthermore, dermatoglyphic asymmetry considers indirect measure of sex hormones in the general population (21).

Since dermatoglyphic patterns are established parentally and genetically determined, the present investigation was undertaken to find out the relationship between digital dermatoglyphics patterns and sex hormones anomalies .

Subject and Methods

Finger-tip dermatoglyphic patterns were obtained by the traditional ink method (22), form 54 males with sex hormones anomalies (age rang 25-45years) attending to the Baghdad Teaching Hospital, ,Baghdad, Iraq, and 55 controls from the same age and geographic background .Patients and controls were asked to full a Performa and their prints recorded.

Two types of digital dermatoglyphics analysis were employed: qualitative and quantitative. For the first, the four main finger tip patterns of dermatoglyphics (arches , radial loops ,ulnar loops and whorls) were recorded , while in the second , two type of dermal ridge count were carried out : total ridge count (TRC) and absolute ridge count (ARC) according to Henry system of finger ridge counting (23) .

To measure the directional asymmetry of total ridge count , Leftward asymmetry (L >) was defined by a higher finger ridge count on the left hand, exceeding the right hand count by at least two .Rightward asymmetry (R>) was defined by a higher finger ridge count on the right hand , exceeding the left hand count by at least tow (20) .

Statistical differences were assessed by Chi- square test ($\chi 2$) and t- test using SPSS program.

Results and Discussion

The percentages of digital patterns found in patients with sex hormones anomalies and controls are summarized in Table (1, 2, 3). Ulnar loops had the highest percentage in both patient and control groups, This was followed by whorls, radial loops and arches in patients group ,and whorls , arches and radial loops in control group . The difference was significant ($\chi 2$ =10.335; D.F.=3 ;P≤0.05), when a comparison was made between the patients of sex hormones anomalies and controls. The difference was mainly contributed by increased and decreased frequencies of whorls (38.2% vs. 33.5%) and ulnar loops (51.7% vs. 58.5%) respectively in patients .So that the patterns intensity index (PII) in patients was 13.5 vs. 12.89 in controls.

Table (1)
Observed number and percentage frequencies of main fingertip dermartologyphic patterns in patients and controls.

Dermatoglyphic Patterns	Patients (Number=54)		Controls (Number=55)	
	No.	%	No.	%
Arches	18	3.3	25	4.5
Radial loop	35	6.5	19	3.5
Ulnar loop	279	51.7	322	58.5
Whorls	208	38.5	184	33.5

X2=10.335 ; D.F.=3 ; P≤ 0.05.

Table (2)
Percent frequencies of digital patterns for each digit in right hand in patients with sex hormones anomalies (P) and controls (C).

Right hand digits			Patients(No.= 54)				Controls (No =55)			
Digits	R1		R2		R3		R4		R5	
Patterns	P	C	P	C	P	C	P	C	P	C
Arches	-	1.81	7.40	7.24	3.70	1.81	-	1.81	-	1.81
Radial loop	-	-	22.22	12.72	11.11	5.45	-	5.45	-	1.81
Ulnar loop	38.88	50.90	24.09	36.36	62.96	72.74	40.76	45.45	77.77	72.75
Whorl	61.12	47.29	46.29	43.65	22.22	20.00	53.70	47.29	22.22	23.63

No arch pattern was found in digits R1, R4, R5, L4 and L5 in patients group .While no radial loop pattern was recorded in R5, L5, L4 in controls group , R1,L1,L3 in both patients and control groups (Table (2,3)).

These results may have some support from previous works which showed a positive correlation between sex hormones anomalies and deviation of dermatoglyphic parameters (19,20). Abnormalities in the growth process , which are liable to distort the alignment of dermal ridges, may result from action of abnormal genes, chromosomal aberration , even from poisoning by a drug or from a viral infection, In some the causes remains unknown. The characteristic patterns in an individual that deviated from the norm must be caused by changing occurring before completion of the fourth fetal month. Since epidermal ridge patterns form early in fetal development and remain unchanged throughout life (21,22).

Table (3)
Percent frequencies of digital patterns for each digit in left hand in patients with sex hormones anomalies (P) and controls (C).

Left hand digits			Patients (No. =54)				Controls (No.=55)			
Digits	L1		L2		L3		L4		L5	
Patterns	P	C	P	C	P	C	P	C	P	C
Arches	5.56	1.81	9.25	10.91	7.40	9.09	-	3.64	-	1.81
Radial loop	-	-	24.04	10.91	-	-	1.86	-	-	1.81
Ulanr loop	38.88	60.00	24.08	38.18	62.96	65.45	55.55	58.18	90.74	85.48
Whorl	55.56	38.19	42.59	40.00	29.64	25.24	42.59	38.18	9.26	10.90

When the quantitative analysis was considered (Table 4) ,a significant difference ($t = 1.899$; $d.f. = 107$; $P = 0.06$) was observed in total ridge counts (TRC). The patients showed higher mean ridge counts than controls for both the TRC (159.81 ± 5.46 vs. 144.61 ± 5.84) and ARC (213.72 ± 11.19 vs. 187.96 ± 11.07) . The results of of TRC analysis may be influenced by a prenatal exposure to sex hormones, and the observed differences between patient and controls may be due to the increased frequency of whorls pattern adding to two counts and width of the finger (22). These results also share a common view of prenatal hormone level effect on increasing the TRC (18, 25), and confirmed by studies on other mammalian species , which refer to a positive significance for prenatal testosterone administration on palmer dermatoglyphics intercourse ridge count of

rhesus monkeys (3, 26).While Slabbekoorn et al. found no support for prenatal hormones influence on TRC in transsexuals (20)

Table 4
The analysis of total ridge count (TRC) and absolute ridge count (ARC) in patients and controls.

Sample	No.	TRC Mean ± S.E.	ARC Mean ± S.E.
Patients	54	159.81 ± 5.46	213.72 ± 11.19
Controls	55	144.61 ± 5.84	187.96 ± 11.07

t = 1.899 ; d.f. = 107 ; P = 0.06.

Among the patients with sex hormones anomalies , 44.44% of them had a higher ridges count on the left hand than on the right (L >) , while 38.18% of the controls had a L > asymmetry . A $\chi 2$ comparing between patients and controls for the direction of ridge asymmetry L> vs. no L> (L not) showed that the difference was not significant ($\chi 2 = 5.183$; D.F.= 3 ; P = 0.158)

Table (5)
Percentage of total finger ridge counts asymmetry in patients and controls.

Sample	N	L>R		R>L		L = R	
		N	L>%	N R>%		N	%
Patients	54	24	44.44	24	44.44	6	11.11
Controls	55	21	38.18	33	60.00	1	01.82

$\chi 2 = 5.183$; D.F. =3 ; P = 0.158.

Our results support the considerable evidence that suggests that dermatoglyphic asymmetry in the hand are effected by early exposure to androgen, because androgen plays important role in sexual differentiation of morphological traits (18, 25).

Since bilateral structures rarely exhibit perfect symmetry, asymmetry may be considered to represent the inability of a developing organism to buffer environmental disturbance (3, 24). A higher percentage of left asymmetry (L >) was found in women than men (25). This directional asymmetry was associated with different patterns of sexually dimorphic cognitive tasks ; composite masculine tasks were performed better by subjects with a right asymmetry (R >). This suggests a relationship between somatic asymmetry, functional brain asymmetry and sexual orientation , which may have its origin in the hormonal environmental of early prenatal life (20).

Our result supports the hypothesis that prenatal sex hormone levels may have a significant effect on the development of dermatoglyphics .

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144.61 ± 5.84) وكذلك لمعدل عدد الخطوط المطلق (213.72 ± 11.19 مقابل 187.96 ± 11.07). وكان الاختلاف معنوياً بالنسبة لمعدل العدد الكلي للخطوط (t = 1.899 ; d.f. = 107 ;p = 0.06) . كما ظهر بأن 44.44% من المرضى يحملون عدداً اكبر من الخطوط في اليد اليسرى مقابل 38% من مجموعة السيطرة .

الاستنتاج : نتائج بحثنا تدعم الافتراض العلمي بأن مستويات الهورمونات قبل الولادة تمتلك تأثيراً معنوياً على تكوين الخطوط الجلدية .

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الخلاصة

الخلفية العلمية : يُعنى علم الخطوط الجلدية بدراسة أشكال الخطوط الجلدية في البنان ، راحة الكف وباطن القدم .و إن تعدد أشكال الخطوط الجلدية هو نتاج لتظافر عوامل الوراثة والبيئة . كما أن تحليل صفات الخطوط الجلدية قد أصبح ذو قيمة في التشخيص الأولي لبعض المتلازمات والأمراض الوراثية .وقد هدف بحثنا إلى تقييم العلاقة بين أنماط الخطوط الجلدية للبنان واضطراب الهورمونات الجنسية .

العمل: تم حساب تكرار أنماط الخطوط الجلدية (التحليل الوصفي) ، وعدد الخطوط الجلدية الكلي والمطلق (التحليل الكمي) وعدم التناظر لعدد الخطوط لـ 54 ذكراً يعانون من اضطراب الهورمونات الجنسية و55 فرداً يمثلون مجموعة السيطرة .

النتائج : اظهر مرضى اضطراب الهورمونات الجنسية اختلافا في تكرار انماط الخطوط الجلدية مقارنة بمجموعة السيطرة ، وخاصة زيادة المستديرات (38.2 % مقابل 33.5%) ونقصان العرويات الزندية (51.7% مقابل 58.5%) ، وقد وصل الاختلاف الى المتسوى المعنوي (قيمة مربع كاي = 10.335 : درجة الحرية = 3 : الاحتمالية 0.05) .

أما بالنسبة للتحليل الكمي فقد اظهر المرضى زيادة في معدل عدد الخطوط الجلدية مقارنة بمجموعة السيطرة ، بالنسبة لمعدل عدد الخطوط الكلي (159.81 ± 5.46 مقابل