Original Research Article

Use of palmar dermatoglyphics in rheumatoid arthritis - A case-control study

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Abstract

Background: The susceptibility and severity of Rheumatoid arthritis are determined by both genetic and environmental factors. Dermatoglyphic patterns of individuals which are formed early in the fetal life are also determined by both genetic and environmental factors. Since both are genetically acquired and environmentally modified, it has been shown that there are particular dermatoglyphic patterns associated with Rheumatoid arthritis. If it is so, dermatoglyphics can serve as an additional tool in the early diagnosis and management of such a disabling disease like rheumatoid arthritis. Although there are some studies which mentioned dermatoglyphic pattern variation in the disease, the results are contradicting. Therefore, the present study was undertaken to find out a possible correlation of some quantitative and qualitative dermatoglyphic variables with Rheumatoid Arthritis.

Aim of the study: To study the dermatoglyphic patterns in patients with Rheumatoid Arthritis and control population and to study the correlation between dermatoglyphic patterns and Rheumatoid Arthritis.

Materials and methods: We studied 60 patients with Rheumatoid arthritis and 60 controls. All were subjected to detailed medical history and clinical examination. Both quantitative (finger ridge count and pattern intensity) and qualitative (fingerprint pattern) dermatoglyphic parameters were studied and the same were compared with age, sex and disease matched controls.

Results: Out of the total 60 cases 12(20%) were male and 48(80%) were females. Of the total 60 controls, 12(20%) were males and 48(80%) were females. Analysis of the qualitative parameters revealed: Significant increase in the number of whorls in both the hands of female patients cases compared to the controls (p-value for right hand 0.001, p-value for left hand 0.004). The decrease in the number of radial loops in both the hands of male and female patients and the decrease was more in the left hand in males and right hand in females (p-value male left hand 0.002, female right hand

0.003). Decrease in the number of arches in the left hand of female patients compared to the controls (p-0.10). Analysis of the quantitative parameters showed: A statistically significant increase in the finger ridge count of individual hand and the total finger ridge count in both male and female patients compared to the controls (p-value males: right hand 0.003, left hand 0.004, right plus left hand 0.002; p-value females right hand.0000, left hand 0.000, right plus left hand 0.000). A statistically significant increase in the pattern intensity of fingers in female patients compared to the controls (p-value: right hand 0.006, left hand 0.001, right plus left hand 0.000).

Conclusion: The findings of this work demonstrate the association between some of the qualitative and quantitative parameters of dermatoglyphics and Rheumatoid arthritis suggesting that dermatoglyphics can represent an anatomical, non-invasive, inexpensive tool for screening high-risk population and thus facilitate early detection and management.

Key words

Rheumatoid Arthritis (RA), Total finger ridge count, 'atd' angle.

Introduction

The clinical course of Rheumatoid arthritis (RA) fluctuates and its prognosis is difficult to predict. In many patients, the disease was severe resulting in progressive joint erosion, destruction and severe disability which are not capable of recovery. Early treatment with the currently available anti-rheumatic drugs may stop or delay such erosions. To avoid the potentially serious side effects, diagnostic tests of high specificity for RA are desirable [1]. The prognostic markers that could identify patients with the aggressive rapidly progressing type of the disease would help in early diagnosis and treatment. They would also protect patients with less aggressive disease from possible overtreatment and toxicities. Both genetic and environmental factors can contribute to the susceptibility and severity of RA disease. Since ridge patterns are formed early in fetal development and remain unchanged throughout life, unusual dermatoglyphics may indicate gene or chromosomal abnormalities consistent with a disease such as Rheumatoid Arthritis [2]. There are a few Indian studies showing a link between rheumatoid arthritis and dermatoglyphics. Although they have mentioned dermatoglyphic pattern variation in the disease, the results are contradicting. Therefore, the present study was undertaken to find out a possible correlation of some quantitative and qualitative dermatoglyphic variables with Rheumatoid Arthritis [3].

Materials and methods

We conducted our study in the teaching hospitals of Kasturba Medical College Hospital and Government Wenlock Hospital, Mangalore during 2011 December-2013 June. Rheumatoid Arthritis Patients with age above18 years, who were diagnosed based on 2010-ACR-EULAR Criteria, after taking written informed consent, were included in the study. Age and sex-matched controls were taken for comparison. For diseases such as diabetes and hypertension, disease matched controls were taken. Patients with congenital diseases and with local injury to the hands were excluded from the study.

The dermatoglyphic patterns which were analyzed in the study were-

1) Different patterns of fingertips (fingerprints).
2) Total finger ridge count.
3) Pattern intensity.
4) 'atd' angle

After wiping the hands clean, the patients were asked to place both hands over the scanner screen and a digital image of the same was obtained. A separate image of the two thumbs and other fingers was taken as and when required. The patterns and ridge counts were read under direct visualization. The 'atd' angle was calculated using the 'screen protractor' software. All the parameters were studied in both hands together and separately. The comparison

was done between patients and controls in both males and females. The data was analyzed based on both qualitative and quantitative parameters. The qualitative parameters are the patterns of the fingerprint namely the loop, whorl, and arch. The quantitative parameters are total finger ridge count, 'atd' angle,'a-b' ridge count and pattern intensity.

The statistical methods

Quantitative variables were analyzed using Students t-test and qualitative variables by Chi-square test. SPSS version 16 was used for analyzing the entire data<0.05 was considered as significant.

Results

Our study was a case-control study with 60 cases with rheumatoid arthritis and 60 controls. **Table – 1** shows out of the total 60 cases, 12(20%) were male and 48(80%) were females. Of the total 60 controls, 12(20%) were males and 48(80%) were females.

Table – 1: Gender distribution in the study group.

Gender	Cases	Controls	Percentage
Male	12	12	20
Female	48	48	80

Table - 2: Pattern distribution in fingertips of males included in the study.

Pattern	Case		Control		P1	P2
	Right hand(mean)	Left hand(mean)	Right hand(mean)	Left hand(mean)		
Whorl	0.75	1.25	0.58	0.58	0.674	0.136
Radial loop	0.75	0.17	1.5	1.42	0.043	0.002
Ulnar loop	2.75	3.08	2.33	2.17	0.499	0.059
Arch	0.67	0.5	0.81	0.83	0.368	0.166

Table – 2 shows qualitative parameter analysis results in males. There was no statistically significant difference in the distribution of whorls in the right and left the hand of male patients compared to controls (**Table – 2a**). There was a statistically significant decrease in the radial loops in male patients compared to the controls and the difference is more in the left hand (**Table – 2b**).There was no statistically significant difference in the pattern of ulnar loop distribution in either hand of male patients (**Table – 2c**).There was no statistically significant difference in the distribution of arches in male Rheumatoid Arthritis patients compared to the controls (**Table – 2d**).

Table – 2a: Whorls-males.

Males-Cases vs Controls	P-value
Right hand	0.674
Left hand	0.136

Table – 2b: Radial loops-males.

Male: Cases vs controls	P-value
Right hand	0.043
Left hand	0.002

Table – 2c: Ulnar loops-males.

Male: Cases vs Controls	P-value
Right hand	0.499
Left hand	0.059

Table – 2d: Arches-males.

Male: Cases vs. Controls	P-value
Right hand	0.368
Left hand	0.168

Table – 3 shows qualitative parameters in female. There was a statistically significant increase in the number of whorls in the right and left hands of female patients compared to the controls (**Table – 3a**). There was a statistically significant decrease in the radial loops in both the hands of female patients compared to the

controls and the decrease is more significant in the right hand (**Table – 3b**).There was no statistically significant difference in the ulnar loop pattern distribution in either hand of female patients (**Table – 3c**).There was a statistically significant decrease in arches in the left hand of females with Rheumatoid Arthritis compared to the control group (**Table – 3d**).

Table – 3: Qualitative parameters in female.

Pattern	Case		Control		P1	P2
	Right hand(mean)	Left hand(mean)	Right hand(mean)	Left hand(mean)		
Whorl	1.10	1.23	0.42	0.65	0.001	0.004
Radial loop	0.56	0.56	1.10	0.94	0.003	0.035
Ulnar loop	2.69	2.75	2.65	2.73	0.861	0.935
Arch	0.67	0.44	0.58	0.75	0.795	0.010

Table - 3a: Whorls-females.

Female: Cases vs. Controls	P-value
Right hand	0.001
Left hand	0.004

Table - 3b: Radial loops-females.

Female: Cases vs. Controls	P-value
Right hand	0.003
Left hand	0.035

Table - 3c: Ulnar loop-female.

Female: Cases vs. Controls	P-value
Right hand	0.863
Left hand	0.935

Table - 3d: Arches-females.

Female: Cases vs. Controls	P-value
Right hand	0.795
Left hand	0.10

Table – 4: Total finger ridge count of right hand of males.

	Case	Control
Mean	71.83	47.67
Median	71	48
Std deviation	24.947	12.116
Minimum	35	32
Maximum	133	63

There was a statistically significant increase in the finger ridge count of right hand in male patients compared to controls (**Table – 4**). There was a significant increase in the ridge count of the left hand in male patients compared to the controls (**Table – 5**). Total finger ridge count (added ridge count of right and left hand) was significantly increased in male Rheumatoid arthritis patients compared to the controls (**Table – 6**). The ridge count of the right hand in female patients was significantly higher than that of controls (**Table – 7**). The ridge count of left-hand fingers in female patients was significantly higher than that of controls (**Table – 8**). The total finger ridge count (right-hand ridge count + left-hand ridge count) was significantly increased in female patients compared to controls (**Table – 9**). The increase in total finger ridge count was more significant in female patients compared to the male patients.

Table – 5: Total finger ridge count of left hand of males.

	Case	Control
Mean	73.50	44.25
Median	78	41.00
Std deviation	25.621	10.056
Minimum	35	35
Maximum	131	69

There was no significant difference in the pattern intensity in male patients compared to the controls (**Table – 9a, 9b, 9c**). There was a statistically significant increase in the pattern intensity in the right hand of females in comparison with controls (**Table – 9d, 9e, 9f**).

Table – 6: Total finger ridge count of right hand+ left-hand males.

	Case	Control
Mean	145.33	91.92
Median	150.50	91.0
Std deviation	49.500	16.594
Minimum	78	70
Maximum	264	118

Table – 7: Total finger ridge count of right hand of females.

	Case	Control
Mean	73.69	43.65
Median	73	44
Std deviation	27.581	12.128
Minimum	29	19
Maximum	131	78

Table – 8: Total finger ridge count of left hand of females.

	Case	Control
Mean	79.04	44.48
Median	73	44
Std deviation	26.734	11.957
Minimum	28	17
Maximum	175	73

Table – 9: Total finger ridge count of females (right + left hand).

	Case	Control
Mean	152.73	88.12
Median	141.00	84.50
Std deviation	50.788	18.699
Minimum	57	54
Maximum	287	151

Table – 9a: Pattern intensity-male right hand.

	Case	Control
Mean	5.33	5
Median	5	5
Std deviation	1.826	1.206
Minimum	3	3
Maximum	10	7

There was a statistically significant increase in the pattern intensity in the left hand of females in comparison with controls. There was a statistically significant increase in the pattern intensity of female patients compared to the controls. This holds true foranalyzing individual hands and both hands together.

Table –9b: Pattern intensity-male left hand.

	Case	Control
Mean	5.58	4.75
Median	5.50	5
Std deviation	1.621	0.622
Minimum	4	4
Maximum	10	6

Table – 9c: Pattern intensity-male total (right + left).

	Case	Control
Mean	10.92	9.75
Median	11	9.50
Std deviation	3.204	1.422
Minimum	7	8
Maximum	20	13

Table – 9d: Pattern intensity of fingers in the right hand of females.

	Case	Control
Mean	5.48	4.60
Median	5	5
Std deviation	1.584	1.198
Minimum	2	2
Maximum	9	8

Table –9e: Pattern intensity of fingers in the left hand of females.

	Case	Control
Mean	5.69	4.88
Median	5	5
Std deviation	1.518	1.044
Minimum	2	3
Maximum	10	8

Table – 9f: Pattern intensity of fingers (total = right + left) in females.

	Case	Control
Mean	11.17	9.48
Median	11	9
Std deviation	2.876	1.598
Minimum	6	6
Maximum	18	16

Discussion

The fingerprint patterns a qualitative parameter and various quantitative parameters like total

finger ridge count and pattern intensity was studied in our work. In our study, we noticed that loops were the most common type of finger print patterns. Igbigbi and Msamati (2002) also demonstrated that the ulnar loop was the most prominent digital pattern in both sexes in their study. Their study documented similarities in digital ridge patterns between some African countries indicating their close historical and anthropological relationship [4]. However, significant differences were demonstrated between them and Europeans. These results show that digital patterns are specific in differentiating ethnic and population groups. In the present study, we observed a significant decrease in the radial loop in both male and female patients. The difference was more significant in the left hand of males and right hand of females. This result is comparable with the study done by Taneja, et al. (1993) who reported a significant decrease in the radial loop in both hands of male patients. In the study done by Ravindranath, et al. (2003) they observed loops were significantly decreased in the third finger of males and a first and fourth finger of females. But they didn't differentiate between radial and ulnar loops[5]. In the study done by Hanan, et al. (2011), there were nonsignificant changes in the radial loop. In our study, there was no statistically significant difference in the ulnar loop pattern in males and females. Hanan, et al. (2011) showed that significant decrease in the ulnar loops in both the hands of male and female patients. Our study showed a significant increase in the number of whorls in both the hands of female patients compared to the control group, but no such differences were noted in the male population. Taneja, et al. (1992) also showed an increase in the whorl pattern in the right hand of male patients and in both the hands of female patients. A study by Ravindranath, et al. showed the contradictory result. There was a significant decrease in the whorl pattern in both the hands of male and nonsignificant change in females. Hanan, et al. (2010) also didn't show any significant difference in the whorl pattern. Regarding arches, in the present work, there was no statistically significant difference in male patients compared to controls. However, it was observed that there was a significant decrease in the arches of the left hand of female patients. The study done by Taneja, et al. showed an increase in the whorl pattern in the right hand of males and both the hands of female patients. Hanan, et al. and Ravindranath, et al. showed a significant increase in the arch count in both the hands of both sexes. Regarding the quantitative parameters, we observed an increase in the ridge count of individual hands and total finger ridge count in both the genders. Rajangam, et al. (2008) showed a significant increase in the total ridge count only in the right hand of male patients [6]. There was no significant difference in the total finger ridge count as per Taneja, et al. Conversely there was a significant decrease in the total finger ridge count in both genders as per Hanan, et al. The pattern intensity of each hand separately and the main pattern intensity (including both hands) showed a significant increase in female patients in our study compared to the control groups [7]. However, there was no significant decrease in the pattern intensity of male patients compared to the control groups. Hanan, et al. showed a decrease in the pattern intensity in both the male and female patients. Dermatoglyphics by themselves are not enough to diagnose Rheumatoid Arthritis. But, the results of this work suggests that dermatoglyphics can at least serve to strengthen the diagnostic criteria of rheumatoid arthritis especially in un-identified patients or those with early signs of joint inflammation [8].

Limitations

Though we analyzed 'atd' angle and 'ab' ridge count, the two important dermatoglyphics parameters, they were not included in the study due to the technical errors.

Conclusion

In conclusion, it has been observed that there were statistically significant differences in both qualitative and quantitative dermatoglyphic parameters in Rheumatoid Arthritis patients compared to the control population. These

observations were in contrast to many of the findings from previous studies. This difference may be attributed to the genotypic differences which exist in the different ethnic groups on whom these studies were conducted. The major limitation of the study was that the sample size was small and may not be representative of the population. The findings of this work demonstrate the association between some of the dermatoglyphics parameters and Rheumatoid arthritis suggesting that dermatoglyphics can represent an anatomical, non-invasive, inexpensive tool for screening high-risk population and thus facilitate early detection and management.

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