

Dermatoglyphics in Alopecia Areata – A Case Control Study

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ABSTRACT

Alopecia areata subjects are characterized by asymptomatic, circular or oval smooth patches of complete loss of hair on scalp, the beard or elsewhere. In the present study alopecia areata subjects were examined in terms of dermatoglyphic characteristics and compared with that of controls. Frequency of loops was decreased in alopecia areata but in case of whorls and arches (not in male subjects) increased numbers are recorded than their counterpart. On palm, a-b ridge count (a-b RC) was found to be increased in both sexes of alopecia areata (statistically significant increase in alopecia areata Female) while atd angles were reduced in females. In male subjects of alopecia areata, true palmar pattern (TPP) was increased in both hypothenar and left interdigital-2 (ID2) areas while in females, TPP were increased in both inter digital area-2 and 3 and left ID4 areas. TPP were reduced in left thenar (Lt. Th.), Lt. ID1, ID3, ID4, Rt. ID2, ID3 and ID4 areas of alopecia areata males and both right and left thenar and hypothenar and right ID4 areas of females. This study reveals deviation in the form of reduction of number of loops and increase in number of whorls and arches in alopecia subjects. Deviation is also observed in a-b ridge count and atd angle. These can be considered as quite useful as a supportive investigation and to some extent knowing the prediction for alopecia areata.

Key words: Ridge Structure, Alopecia areata, Maharashtra, India

INTRODUCTION

The surface of the epidermis is marked by elevations and depressions which are most prominent on the palms and the ventral surfaces of the fingers and on the corresponding surfaces of the feet. The elevations form characteristic epidermal ridges that are responsible for the highly specific finger prints of each individual (Singh,2006). The epidermal ridges that produce typical patterns on the surface of the fingertips, palms of the hand and soles of the feet are genetically determined. They form the basis for dermatoglyphic studies in medical genetics and criminal investigations (Sadler, 2006).Dermatoglyphic patterns make good material for genetic studies because unlike stature, intelligence, and body weight, they are not influenced by age (so that adults can be compared accurately with children), or by postnatal environmental factors. Nor are they subject to any influences in the later prenatal period because the formation of ridge patterns is already completed by about the eighteenth week of gestation (Loesch, 1983).

Alopecia areata is characterized by asymptomatic, circular or oval smooth patches of complete loss of hair on scalp, the beard or elsewhere. Rarely may it progress to involve all the hairs of scalp (Alopecia totalis) and even hair of whole body (Alopecia universalis). Certain factors such as genetic, immunological, endocrinal and psychological have been incriminated in its etiology (Jain andDeshore, 2000).Messenger (2004) defined alopecia areata as a chronic inflammatory disease that involves the hair follicle and sometimes the nails and caused by a T- cell mediated autoimmune mechanism occurring in genetically predisposed individuals. The present study is an attempt to study the finger and palmar dermatoglyphic patterns in patients suffering from alopecia areata and to compare dermatoglyphic configurations of alopecia areata with that of normal population.

MATERIALS AND METHODS

The present study was carried in the Department of Anatomy Mahatma Gandhi Institute of Medical Sciences (MGIMS) and out-patient Department of Dermatology, Venereology

and Leprosy of Kasturba Hospital of MGIMS, Sevagram, Maharashtra, India from May 2004 to November 2006. The study population consisted of 63 clinically diagnosed cases of alopecia areata from Sevagram, Wardha and surrounding areas. The controls (104) were students, Doctors, Nursing staff, paramedical staff and visitors of the institute (MGIMS).

After taking informed consent rolled fingerprints and handprints of palmar surface of both hands were taken by the ink method as suggested by Cummins and Midlo (1943). We followed Galton's classification for characterization of fingertip and palmar patterns, based on the number of triradii present.

The present study was conducted among the 63 clinically diagnosed alopecia areata subject attending O.P.D. of this institute. Side by side, 104 age-sex and population matched normal subject were studied as control in this respect. In our study out of control subjects, 55 were males (CM) and 49 were Females (CF). While, out of total alopecia areata patients, 33 were males (AM) and 30 were females (AF). Each hand print was observed and analyzed from the following aspects / parameters, separately according to side and sex and also both sides and sexes together. It includes the following:

- (a) Qualitative analysis of fingertip patterns (FTP): loops, whorls and arches.
- (b) Quantitative analysis of fingertip pattern: finger ridge count (FRC)

We analyzed the ridge counts as Cummins and Midlo (1943) and Schaumann et al., (1976) for the following:

- (a) The total finger ridge count (TFRC)
- (b) The absolute finger ridge count (AFRC)

This involves 10 digits of a subject, which means all digits of both hands. Mean values of the above are mentioned and analyzed according to sex and diagnosis. Quantitative analysis of palm of each hand /side was done separately and then sum of both hands together that is, a-b ridge count was observed. Side by side, qualitative analysis of palmar pattern of each hand was done separately for True palmar pattern (TPP) which also includes duplex or double true palmar pattern (DPP).

RESULTS

1)Fingertip pattern:

(a) Loops:

When we compared the prints of alopecia areata with that of controls it is observed that both alopecia males and females showed a decreased percentage of ulnar loops (male-50.8 per cent; female-51.3per cent), radial loops (male-1.5per cent; female-0.3per cent) and also total loops (male-52.4per cent; female-51.6per cent).Whereas, among the controls increased per cent of ulnar loops (male-52.9per cent; female-60.7per cent), radial loops (male-2.3per cent; female-2.6per cent) and total loops (male-55.2per cent; female-63.3per cent) is observed. However, when each sex compared separately and also as combined series of both sexes no statistical significance is observed.

(b)Whorls:

Both total simple whorls (TSW) and total whorls (TW) were increased in percentage both in alopecia areata male (TSW-38.7per cent; TW-44.7per cent) and female(TSW-32per cent; TW-42.3per cent) subjects in comparison with control male (TSW-31.5per cent; TW-42.2per cent) and female(TSW-24.4per cent; TW-42.3per cent). In combined male female series of both hands we found that there was increased percentage of total simple whorls (35.3per cent) and total whorls (43.4per cent) in comparison with simple whorls (27.9per cent) and total whorls (38per cent), though these findings were statistically not significant.

c)Arches:

Total Arches (TA) were increased in percentage in alopecia areata female (5.9per cent) than control female (2.4per cent). The same trend is noticed in combined male female series (alopecia areata-4.3per cent; control-2.5per cent). But male alopecia areata subjects showed a very minimum decrease by 0.2 per cent, when compared with that of control subjects. There was no statistically significant difference.

2) Finger ridge count:

The present study showed increased mean value of total finger ridge count (TFRC) and absolute finger ridge count (AFRC) in both sexes of alopecia areata when compared to controls. In alopecia areata male subjects TFRC was estimated to be 160 and AFRC was 220, while in control males TFRC and AFRC were 149 and 202 respectively. Similar picture of increased finger ridge count was also seen in case of alopecia areata female. TFRC and AFRC among alopecia females are 145 and 203 respectively, while in control female TFRC was 135 and AFRC was 175, but there was no significant difference. The range of the TFRC in CM, AM, CF and AF were 29-232, 63-231, 50-202 and 38-245 respectively. Side by side, the range of the AFRC in CM, AM, CF and AF were 29-399, 73-376, 56-357 and 38-391 respectively.

3) a-b ridge count:

Present study showed increase in the mean value of a-b ridge count (sum of right and left) in both sexes of alopecia areata as compared to controls. In alopecia areata male a-b ridge count was 81, while that of control male was 79. In Alopecia areata female, a-b ridge count was 78, while that of control female was 73. The range of a-b ridge count (sum of Rt. and Lt.) in CM, AM, CF and AF were 64-111, 60-113, 60-110 and 62-112 respectively.

Table-1: a-b ridge count

Parameter	Sex	Control		Alopecia areata		t	P value
		Mean (SD)	Range	Mean (SD)	Range		
a-b ridge count	Male	79.2±10.86	64-111	81.18±9.50	60-113	0.90	0.40
	Female	72.8±10.03	60-110	78.90±10.91	62-112	2.50	0.05 *

*Indicates significant difference

Table 1 showed that in respect of t-test there was statistically significant increase in the mean value of a-b ridge count of alopecia areata Female (78.90 ± 10.91) when compared with that of control female (72.8 ± 10.03).

4) atd angle:

In alopecia areata male, mean value of atd angle was increased in each side in comparison with controls (CM-41 and AM-44). But in alopecia areata female, mean value of atd angle was decreased in Rt.(AF-41, CF-42) and same in Lt. side, when compared with control females (both AF and CF-41), but we did not find statistical significant difference. The range of atd angle of Rt. side in CM, AM, CF and AF were 33-61, 36-64, 37-73 and 34-51 respectively and of Lt. side in CM, AM, CF and AF were 31-57, 35-60, 33-50 and 32-51 respectively.

5) True palmar pattern (TPP):

The present study showed increased percentage of TPP in right hypothenar area and marked decrease in percentage of TPP in Rt. ID₂, ID₃, and ID₄ areas in Alopecia areata male as compared to controls. Side by side, increased percentage of TPP was noticed in Lt. hypothenar and decreased percentage of TPP in Lt. ID₃, ID₄ areas in Alopecia areata male as compared to control. Decreased percentage of TPP was noticed in Lt. ID₁, and left thenar area but in Lt. ID₂ we found increased percentage of TPP in alopecia areata male as compared to control. Decreased percentage of TPP was also noticed in both Rt. and Lt. hypothenar and thenar areas and increased percentage of TPP in both Rt. and Lt. ID₂, ID₃ areas in alopecia areata female as compared to control. Right ID₄ showed decreased percentage of TPP and left ID₄ showed increased percentage of TPP in alopecia areata female as compared to controls.

Table-2: True palmar pattern (TPP) at hypothenar area

Hypothenar TPP	Control (n=104)		Alopecia areata (n=63)		Chi square	P value
	No.	%	No.	%		
Right	Males (55)	20.0	Males(33)	21.2	0.02	0.89
	Females(49)	22.4	Females(30)	3.3	3.9	0.04*
	Total (104)	21.2	Total (63)	12.2	1.9	0.16
Left	Males (55)	18.0	Males (33)	21.2	0.12	0.72
	Females(49)	32.6	Females(30)	3.3	9.47	0.002*
	Total (104)	25.3	Total (63)	12.2	3.66	0.05*
Both	Males (55)	19.0	Males (33)	21.2	0.12	0.72
	Females(49)	27.5	Females(30)	3.3	6.87	0.008*
	Total (104)	23.2	Total (63)	12.2	2.73	0.09

*Indicates significant difference

It is revealed from Table 2 that there was statistically significant decrease of percentage of TPP of alopecia areata females in Rt. (3.3%) and Lt. side (3.3%) and also when both sexes combined (12.2%). But when both hands are combined the females showed statistically significant difference between Alopecia and control subjects.

Table-3: True palmar pattern (TPP) at ID 3

Hypothenar TPP	Control (n=104)		Alopecia areata (n=63)		Chi Square	P value
	No.	%	No.	%		
Right	Males (55)	54.5	Males(33)	48.4	0.30	0.58
	Females(49)	57.1	Females(30)	73.3	2.10	0.14
	Total (104)	55.8	Total (63)	60.8	0.33	0.56
Left	Males (55)	36.0	Males (33)	24.2	1.4	0.23
	Females(49)	48.0	Females(30)	80.0	7.51	0.006 *
	Total (104)	42.0	Total (63)	52.1	1.93	0.165
Both	Males (55)	45.2	Males (33)	36.3	0.70	0.40
	Females(49)	52.0	Females(30)	76.6	5.13	0.02 *
	Total (104)	48.6	Total (63)	56.4	1.03	0.30

*Indicates significant difference

Table 3 showed that there was statistically significant increase of the percentage of TPP in ID3 palmar area of Alopecia Areata female in Lt. side (80.0%) and both side combined (76.6%), in comparison with that of control female (48% & 52%) and the P values were 0.006 and 0.02 respectively.

Table-4: True palmar pattern (TPP) at ID 4

Hypothenar TPP	Control (n=104)		Alopecia areata (n=63)		Chi Square	P value
	No.	%	No.	%		
Right	Males (55)	56.3	Males(33)	30.3	5.63	0.01 *
	Females(49)	55.1	Females(30)	53.3	0.02	0.87
	Total (104)	55.7	Total (63)	41.8	3.30	0.06
Left	Males (55)	58.1	Males (33)	6.6	23.63	0.000001*
	Females(49)	57.1	Females(30)	63.3	0.30	0.58
	Total (104)	57.6	Total (63)	34.9	8.14	0.004 *
Both	Males (55)	57.2	Males (33)	36.9	3.3	0.06
	Females(49)	56.2	Females(30)	58.3	0.00	0.96
	Total (104)	56.7	Total (63)	47.6	1.31	0.25

*Indicates significant difference

It revealed from Table 4 that there was statistically significant decrease of the percentage of TPP in ID4 palmar area of alopecia areata male in Rt. (30.3%) and Lt. side (6.6%) and in Lt. side only of combined male-female series (34.9%), when compared with that of control female (56.3%, 58.1% and 57.6% respectively), and the P values were 0.01, 0.000001 and 0.004 respectively.

Thus in fine it can be said that when we studied dermatoglyphics in alopecia areata and compared it with that of control, on analyzing finger tip pattern we found that loops were generally decreased but there were increased number of whorls and arches (not in male subjects) and increase in the number of absolute and total finger ridge count (AFRC and TFRC). On palm, a-b ridge count was found to be increased in both sexes of alopecia areata (statistically significant increase in alopecia areata female), while atd angles were reduced in females. Side by side, when we studied palmar pattern we found that in male

subjects of alopecia areata, true palmar pattern (TPP) were increased in both hypothenar and Lt. interdigital-2 (ID2) areas while in females, TPP were increased in both inter digital area-2 and 3 and Lt. ID4 areas. TPP were reduced in left thenar (Lt. Th.), Lt. ID1, ID3, ID4, Rt. ID2, ID3 and ID4 areas of Alopecia Areata males and both Rt. and Lt. thenar and hypothenar and Rt. ID4 areas of females. A summary of the above findings have been furnished below in Table 5.

Table-5: Summarized Table

PARAMETERS	AM	AF	Alopecia areata (both sexes combined)
TL, TUL	↓	↓	↓
TRL	↓	↓	↓
TSW, TW	—	—	—
TA	±	—	—
TFRC	—	—	—
AFRC	—	—	—
a-b RC	—	⁴	—
↓ TPP	Rt.ID2,3,4 ⁴ and Lt.Th. Lt.ID1,3,4 ⁴	Rt.Hyp. ⁴ Th, ID4. & Lt.Hyp ⁴ Th.	Lt. Hyp,ID4 ⁴ Both Th& ID1
TPP	Rt. Hyp., and Lt Hyp., ID2	Rt. & Lt. ID2, ID3 ⁴ and Lt. ID4	ID2,3
atd	—	↓	*

= Increased (compared to corresponding controls); ↓ = decreased (Compared to corresponding controls); ⁴= statistically significant; ± =Equivocal (compared to corresponding controls); * =Not commentable

DISCUSSION

Dermatoglyphics as a diagnostic tool is well established in a number of diseases having strong hereditary or genetic basis (Schaumann and Alter, 1976; Loesch, 1983; Gangane, 2004; Sadler, 2006). It reveals from the present study that percentage frequency of loops (percentages of all types of loops were found to be decreased in alopecia areata, as compared with that of controls) coincided with study done by Kapur and Verma (1982). They studied male subjects of alopecia areata and found decreased incidence of loops (48.4%) in comparison with control group. Percentage of ulnar loops was found to be decreased only in Verbov's (1968) study. Decreased percentage of ulnar loops as found in this study coincided with study done by Verbov (1968). But frequency of Loops partially coincided with study of Verma et al. (1981) as they found 10% decrease of loops in Alopecia female subjects similar to that of present findings but no difference exists in digital pattern between Alopecia males and controls in their study. In this study 2% decrease was however, noted. Findings of present study did not coincide with study done by Singh et al.,(1985) as they observed increased percentage of loops in both males (55.4%) and females (66.6%) probably due to larger sample size and variation of sub classification of FTP in their study.

Frequency of whorls in alopecia areata (increased percentage of total simple whorl (TSW) and total whorls (TW) in alopecia areata male and female separately and also in combined series, as compared to that of controls) coincided with study of Verbov (1968) {increased percentage of whorls in male}, Sharma et al. (1977) {increased percentage of whorls in female} and Kapur and Verma (1982) they studied males only and they got statistically significant increase of whorls in Alopecia areata. The present study partially coincided with study done by Singh et al.,(1985) as they found increased whorl pattern in alopecia females, similar to our findings and decrease of the same in case of male alopecia subjects, unlike observation of the present study possibly due to larger sample size in their study.

Frequency of arches in alopecia areata coincided with Selmanowitz et al. (1974) and Verma et al., (1981) (who also found increased percentage of arches in females).In

male alopecia areata, the percentage of arches was found to be slightly decreased when compared with controls. The decrease in arches in male cases coincided with study of Kapur and Verma (1982), present study shows only one arch over second digit of left hand. Observation of the present study partially coincided in case of male alopecia subjects and did not coincide in case of female subjects, with study done by Sharma et al. (1977) as they got decreased incidence of arches in both sexes. This variation is due to too small sample size of their study. However, the male-female combined series of present study showed an increased percentage of total arches.

Finger ridge count (TFRC & AFRC) in alopecia areata shows increased mean value of TFRC and AFRC in both sexes when compared to controls. This coincided with study done by Singh et al., (1985) and also with study done by Kapur and Verma (1982). Kapur and Verma (1982) studied males only and found a higher average of TFRC in Alopecia males (148) than control males (142). Sharma et al. (1977) had similar observations like present study. Our study partially coincided with study done by Verma et al., (1981), as they got no significance in changes during comparison with controls. But they found that male subjects (both control and alopecia) had higher ridge counts than female subjects (TFRC in their CM 142, CF 123, AM 129, AF 128). This feature was much more prominent in this study due to larger sample size.

Present study also showed that mean value of atd angle was increased in alopecia male and decreased in alopecia female, as compared to controls. Mean value of atd angle coincided with study of Singh et al., (1985). They got similar findings (with statistical significance) of increased atd angle, like present study in male subjects and reduction of atd angle in females. True palmar pattern (TPP) in alopecia areata showed increased percentage of TPP in Rt. and Lt. hypothenar area of male and Rt ID2, ID3 and Lt ID 2, ID3 and ID4 in female. This coincided with study of Singh et al., (1985). but did not coincide with study of Verbov (1968) who studied only ID4 area and found TPP to be increased in males and decreased in females. The difference in Verbov's (1968) findings with present study (except Rt. ID4) might be due to larger sample size of his study.

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