*Original Article*

Indian Journal of Anatomy
Volume 4 Number 3, September - December 2015
https://dx.doi.org/10.21088/ija.2320.0022.4315.2

# Palmar Main Line Terminations and Position of 't' Triradius in Primary Epilepsy

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**Abstract**

Epilepsy is a common worldwide health problem with several personal, familial and social impacts. It has a worldwide incidence of 0.3 to 0.5%.The cause of epilepsy is not known and 70% belonged to Idiopathic variety. *Objective:* This study examines the Palmar Main line terminations and position of 't' triradius among individuals with Primary epilepsy in comparison to the controls. *Methods:* The study included Sixty established cases of primary epilepsy in the age group 05-12yrs who were compared with 60 healthy children of the same age group. The palmar prints were taken using Ink-pad method described by Commins and Midlo. Inverted T pad, ink slab made of plain glass, white paper and cyclostyling ink were used for obtaining prints. Various parameters for palm including termination of main lines (D,C,B and A) and position of T were studied. The results were compared with those of controls. *Results and conclusion:* The analysis of data showed a statistically significant difference in termination of A- line between patients controls ($X^2 = 6.66$; d.f.2). The differences observed in D,C and B line terminations were statistically nonsignificant. No significant difference was observed in number and position of 't' ($X^2 = 1.83$; d.f.2) . Very few studies using similar parameters are available now hence there is a need for a study with larger sample size for confirming the results.

**Keywords:** Epilepsy; Cryptogenic; Idiopathic Epilepsy; Palmar Main Line.

## Introduction

Epilepsy is a common worldwide health problem and has severe personal, familial and social impact. It has a worldwide incidence of approximately 0.3 to 0.5% in different populations and its prevalence has been estimated at 5-10/1000 [1].

Epilepsy is defined as a group of disorders with recurrent episodes of altered cerebral functions and paroxysmal excessive hyper-synchronous discharge of cerebral neurons. The clinical accompaniments of these episodes vary in manifestations, from brief lapses of awareness to prolonged bouts of unconsciousness, limb jerking and incontinence [2].

The cause of epilepsy is not exactly known. Majority of the authors say that 70% belonged to idiopathic epilepsy (cryptogenic) and about 30% are secondary to various causes such as brain trauma, CNS infections, cerebro vascular diseases and brain tumors. Both genetic and environmental factors contribute to the etiology of epilepsy. The primary cause could be genetic and a number of genes have been mapped, Baulac et al (2001) [3] and Brismar (2000) [4]. Studies of twins also confirmed the hereditary influence of the disease(Lennox and Lennox,1960) [5]. Over 140 Mendelian disorders have been found to cause seizures and collectively account for about 1% of all epilepsies [6].

The word "dermatoglyphics" coined by Cummins and Midlo (1926) originates from the Greek words "Derma" (skin) and "Glyphae" (carve) [7].

The dermal ridges are formed during third and fourth months of fetal life. Changes may be seen in the palm and ridges in association with epilepsy, since both skin and CNS develop from the same germinal layer(ectoderm) [8]. The dermatoglyphic configurations once formed remain unchanged throughout life and they are highly heritable [9,10].

In this study we aim to probe into the palmar mainline terminations and position of 't' which are

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specific among epileptics, when compared with the controls.

## Material and Methods

*Source*

This case-control study was conducted on 60 known cases of Primary (Idiopathic) epilepsy in the age group of 5-12 years, attending Neurology OPDs of two multi specialty hospitals in South Maharashtra. Children of both sexes were included in the study and those with epilepsy due to other causes were excluded from the study. The controls were 60 normal children in the same age gp of 5-12 yrs. The cases included 42 males and 18 females whereas the controls included 32 males and 28 females. Both the cases and controls represent any religion or caste group from all over India, but residing in this region of Maharashtra state.

*Methods*

A detailed history of the patient, including history of illness, past medical history, antenatal and natal history, immunization, developmental and family history was recorded in a proforma and a thorough physical examination was carried out.

*Dermatoglyphic Printing*

Palmar prints of both hands were taken using Ink and pad method as described by Cummins and Midlo (Schauman and Alter,1976) [7].

*Equipment*

a. Ink slab (25cm X 15 cm X 5 cm) made of plain glass with smooth surface.
b. White paper slightly glazed
c. Inverted T shaped pad of 7cm diameter
d. Black cyclostyling ink

Name of the individual, sex, age and other details were recorded. The prints of both palms were taken after explaining the aim of the study and the procedure for taking prints to the cases / controls. The prints were examined and repeat prints were taken for those found unclear. Examination of prints was done with the help of a 3¼ inch diameter-magnifying lens of 5x power for studying the dermatoglyphic patterns. The markings in the pattern areas are made using a sharp HB Pencil.

*System of Analysis*

*Main Line Termination and Inter-Digital Patterns*

The six areas in the palm viz. hypothenar (Hy), thenar (Th) and the four interdigitals ($I_1$, $I_2$, $I_3$, $I_4$), each constitute a topographic unit, its individuality being expressed both by the existence in some palms of a discrete pattern and by the characteristic presence of partial boundaries formed by palmar triradii (a,b,c,d and t) and their radiants (Fig 1). Based on the four digital triradii, located in proximal relation to the bases of digits II, III, IV, V and tracing their proximal radiant directed toward the interior of the palm; the main-line termination is composed. Having traced the four main lines, the symbols for their terminations are ascribed as main-line termination. While the palmar triradii are recognized in the order a, b, c, d and t, the traced main line of each triradius is recorded as Palmer Main Line Formula D,C,B,A and T (Fig 2). Anatomical position of C-line termination is also observed as Ulnar, Radial, Proximal or Absent subject to its direction of ending.

Among all the main lines, the termination of T is more or less constant i.e., position 13. Rarely, it may terminate at position 11. However, there is considerable variations observed in the positional migration as well as the number of t triradii on palm. The distal migration of axial triradius t has been associated with Mongolism, where it produces a wide atd angle (Fig 3). A wide angle has been observed among the normal population too, though such occurrence is very minimal (Bhanu 1999) [11]. In this study, Bhanu's method of ascertaining t position has been followed [11,12]. The method is described below:

Total number of t-triradii and its anatomical position is described as 1) t-Ulnar / Radial / Axial 2) t'-Ulnar / Radial / Axial 3) t"-Ulnar / Radial / Axial 4) t'"-Ulnar / Radial / Axial. To decide the position of t, the most medial point of distal transverse crease is joined to the distal end of metacarpal digital crease of thumb at I$^{st}$ inter-digital area. This is called the Palmar Transverse Axis (PTA). Then a perpendicular line is drawn proximally from the middle of the third digit up to the wrist crease. This axis is known as Palmar Longitudinal Axis (PLA). This divides palmar area into Ulnar, Radial and Axial. The area proximal to PTA is then divided into four equal parts by three equidistant and parallel lines between PTA and wrist crease, which denotes the positions as t, t', t'', t'" from proximal to distal, where the PTA intersects the PLA (Fig 12) [11,12].

*Analysis of Prints and Statistical Consideration*

All prints for the above parameters have been

analyzed first manually and data entry was done in computer for further statistical analysis. After manual analysis and verification of prints, general frequency of all dermatoglyphic parameters for the patients and the controls were calculated. Employing Chi-square test of significance, the observed and the expected values of all the parameters in the patients and controls were compared as :

$$X^2 = \frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}}$$

## Observations and Results

Main-Line Termination Of D,C,B, A and T

*D-Line Termination*

As seen from table-1, the position of D line termination varies bilaterally among the patients and the controls. The position of D line termination on left hand of the patients is in the decreasing order of 7>9=11>8>10 where as on right hand it is 11>7>9>10>8. The D line termination on left hand of the controls is 7>9>11>10, whereas on right hand it is 11>7>9>10>8. Thus the D line termination shows slight variation in position on the left hand between patients and the controls. When both hands are merged together course of D line termination is highest at Position -11, followed by Position-7 among the patients whereas among the controls it is highest at position - 7 and then at position-11. The position of D line termination on both hands is 11>7>9>10>8 among the patients and 7>11>9>10 among the controls. This difference among the patients and controls is *statistically non- significant ($X^2 = 1.86$; d.f.2).*

**Table 1:** Frequency of distribution of D line termination among patients & controls

| Position | 7 | 8 | 9 | 10 | 11 | Tot. |
|---|---|---|---|---|---|---|
| Patient Lh | 31.7 | 1.7 | 28.3 | 10.0 | 28.3 | 60 |
| Rh | 26.7 | 1.7 | 20.0 | 1.7 | 50.0 | 60 |
| Lh+Rh | 29.2 | 1.7 | 24.2 | 5.9 | 39.2 | 120 |
| Control Lh | 41.7 | 0.0 | 36.7 | 1.7 | 20.0 | 60 |
| Rh | 26.7 | 0.0 | 23.3 | 5.0 | 45.0 | 60 |
| Lh+Rh | 34.2 | 0.0 | 30.0 | 3.3 | 32.5 | 120 |

*C-Line Termination*

As seen from table 2, the position of C line termination varies bilaterally among the patients and controls. The position of C line termination on left hand of the patients is 9>7>5">8>0>6 where as on right hand it is 9>7>5">8>0>6=10>11. The position of C termination on left hand of the controls is 9>5">7>0>8>5' where as on the right hand, it is 9>5'>7=0=8>11. Thus the C line termination shows slight variation in the position in left hand as well as the right hand between the patients and controls. Also when both hands merged together, the frequency of position of C line termination differed among the patients and the controls. The course of c line termination on both hands is 9>7>5">8>0>6>10>11 among the patients and 9>5">7>0>5'=8>11 among the controls. This difference among the patients and the controls is statistically non-significant ($X^2 = 7.30$; d.f.4).

**Table 2:** Frequency of distribution of C line termination among patients & controls

| Position | 0 | 5' | 5" | 6 | 7 | 8 | 9 | 10 | 11 | Tot. |
|---|---|---|---|---|---|---|---|---|---|---|
| Lh | 10.0 | 0.0 | 16.7 | 1.7 | 28.3 | 11.7 | 31.7 | 0.0 | 0.0 | 60 |
| Patient Rh | 6.7 | 0.0 | 8.3 | 3.3 | 20.0 | 6.7 | 50.0 | 3.3 | 1.7 | 60 |
| Lh+Rh | 8.3 | 0.0 | 12.5 | 2.5 | 24.2 | 9.2 | 40.8 | 1.7 | 0.8 | 120 |
| Lh | 10.0 | 3.3 | 18.3 | 0.0 | 16.7 | 6.7 | 45.0 | 0.0 | 0.0 | 60 |
| Control Rh | 8.3 | 11.7 | 0.0 | 0.0 | 8.3 | 8.3 | 61.7 | 0.0 | 1.7 | 60 |
| Lh+Rh | 9.2 | 7.5 | 9.2 | 0.0 | 12.5 | 7.5 | 53.6 | 0.0 | 0.8 | 120 |

*C-Line Position*

From table 3, it is observed that the frequency of C line termination at the radial position among the patients (43.4%) and the controls (54.2%) when both hands were merged together was statistically non-significant ($X^2 = 3.20$; d.f.1). The right hand showed more number of radial C terminations and the left hand showed more ulnar terminations among the patient as well as the controls. This difference between left and right hand is statistically significant among the patients ($X^2 = 5.25$; d.f.1) as well as among the controls ($X^2 = 5.32$; d.f.1). The difference between all possible C-line endings i.e., ulnar, radial, proximal and absent is statistically non-significant ($X^2 = 3.83$; d.f.3) between the patients and controls.

**Table 3:** Anatomical position of C line termination among patients & controls

| Position | Radial(%) | Ulnar(%) | Proximal(%) | Absent(%) | Total No. |
|---|---|---|---|---|---|
| Lh | 31.7 | 46.7 | 11.7 | 10.0 | 60 |
| Patient Rh | 55.0 | 31.7 | 8.3 | 5.0 | 60 |
| Lh+Rh | 43.4 | 39.2 | 10.0 | 7.5 | 120 |
| Lh | 45.0 | 38.3 | 6.7 | 10.0 | 60 |
| Control Rh | 63.3 | 20.0 | 8.3 | 8.3 | 60 |
| Lh+Rh | 54.2 | 29.2 | 7.5 | 9.2 | 120 |

*B-Line Termination*

As seen from table 4, the position of B line termination slightly varies bilaterally among the patients and the controls. The B line termination on left hand of the patients, in descending order of frquency is 7>5">5'>6 where as on right hand it is 7>5">5'>8>9. The frequency of B termination on left hand of the controls is 7=5">5'>4 where as on right hand it is 7>5''>5'>9. Thus the B line termination shows slight variation in position in left hand as well as right hand of the patients and controls. Also when the datas are merged together the positions of B termination differ slightly between the patients (7>5''>5'>6>8>9) and controls (7>5''>5'>9>4) but it is statistically non- significant ($X^2 = 0.01$; d.f.1).

**Table 4:** Frequency of distribution of B line termination among the patients & controls

| Position | 4 | 5' | 5'' | 6 | 7 | 8 | 9 | Tot. |
|---|---|---|---|---|---|---|---|---|
| Lh | 0.0 | 23.3 | 33.3 | 6.7 | 36. 7 | 0.0 | 0.0 | 60 |
| Patient Rh | 0.0 | 16.7 | 28.4 | 0.0 | 46.7 | 5.0 | 3.3 | 60 |
| Lh+Rh | 0.0 | 20.0 | 30.8 | 3.3 | 41.7 | 2.5 | 1.7 | 120 |
| Lh | 1.7 | 28.3 | 35.0 | 0.0 | 35.0 | 0.0 | 0.0 | 60 |
| Control Rh | 0.0 | 20.0 | 21.7 | 0.0 | 53.3 | 0.0 | 5.0 | 60 |
| Lh+Rh | 0.8 | 24.2 | 28.3 | 0.0 | 44.2 | 0.0 | 2.5 | 120 |

*A-Line Termination*

As seen from table 5, the position of A line termination slightly varies bilaterally among the controls and patients. The frequency of A line termination on left hand of the patients is 3>4>5'>5''>1 where as on right hand it is 3>4>5'>5''>11. Among Controls, on left hand it is 3>4>5'>11>1 where as on right hand it is 3>5'>4>11>1>5''. Also when dtas of both hands were merged together the position of A line termination differed among the patients and the controls and this difference is statistically significant ($X^2 = 6.66$; d.f.2). The frequency of A line termination, with both hands taken together is 3>4>5'>1>5''>11 among the patients and 3>4>5'>11>1>5'' among the controls.

**Table 5:** Frequency of hand wise distribution of A line termination among the patients & controls

| Position | 1 | 3 | 4 | 5' | 5'' | 11 | Tot. |
|---|---|---|---|---|---|---|---|
| Lh | 5.0 | 56.7 | 20.0 | 15.0 | 3.3 | 0.0 | 60 |
| Patient Rh | 0.0 | 38.3 | 30.0 | 25.0 | 1.7 | 5.0 | 60 |
| Lh+Rh | 2.6 | 47.5 | 25.0 | 20.0 | 2.0 | 2.5 | 120 |
| Lh | 1.7 | 68.3 | 11.7 | 11.7 | 0.0 | 6.7 | 60 |
| Control Rh | 1.7 | 53.3 | 18.3 | 16.7 | 1.7 | 8.3 | 60 |
| Lh+Rh | 1.7 | 60.8 | 15.0 | 14.2 | 0.8 | 7.5 | 120 |

*T Line Termination*

Majority of the T termination was at position 13, both among the patients (97.6%) as well as the controls (98.4%). Remaining 3.4% of T among the patients terminated at position 11 on the left hand where as among the controls only one individual had T termination at position 4 on right hand and another had T termination at position 5' on left hand.

*Total Number of 'T' Triradii and Their Position*

No specific trend has been observed for the number of t among the patients and the controls. Majority of the patients (87%) as well as controls (82%) had only one t and the remaining 13% of patients and 18% of controls had two t triradii in each palm.

As seen from table 6, most of the t triradii lie at the position of t-ulnar (P-72%, C-63.6%). The remaining were at t'– ulnar (P-16.9% , C-23%) , t"- ulnar (P-8.8%, C-10%) and t"'- ulnar (P-2.2%, C-3.3%). Only one palm among controls was found to be with a t-axial. Existing slight difference in the t position among the patients and control is statistically non-significant ($X^2 = 1.83$; d.f.2).

**Table 6:** Frequency of position of t on both hands (Lh+Rh) : Patients vs Controls

| Position | t-ul | t'-ul | t''-ul | t'''-ul | t-ax | Tot. |
|---|---|---|---|---|---|---|
| No | 98 | 23 | 12 | 3 | 0 | 136 |
| Patient % | 72.0 | 16.9 | 8.8 | 2.2 | 0.0 | |
| No | 91 | 32 | 14 | 5 | 1 | 143 |
| Control % | 63.6 | 23.0 | 10.0 | 3.3 | 0.8 | |

**Table 7:** Main Line terminations showing various position among the patients and controls

| Main Line | Patient | Control |
|---|---|---|
| D. | 11>7>9 | 7>11>9 |
| C. | 9>7>5 | 9>5>7 |
| B. | 7>5>6 | 7>5>9 |
| A. | 3>4>5 | 3>4>5 |

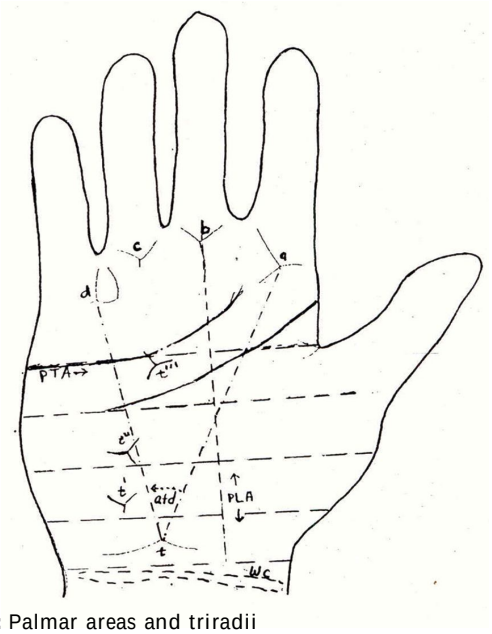
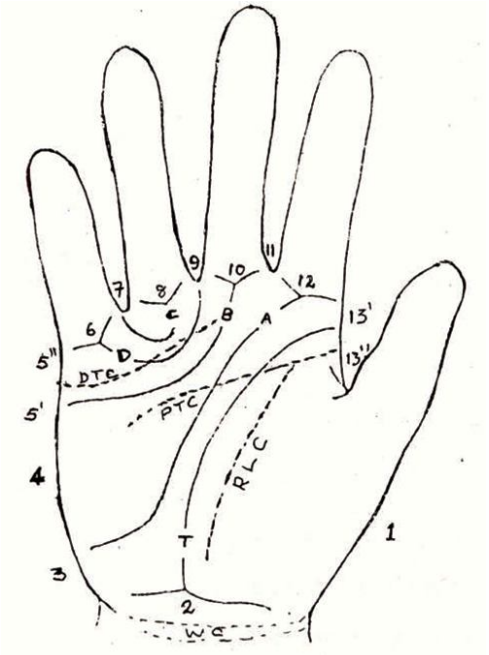



**Fig. 1:** Palmar areas and triradii




**A.B.C.D: Palmar main lines.**
**T: Main line T.**
**I-13: Area or paint of main line terminus**

**Fig. 2:** Palm showing Main Line Formula

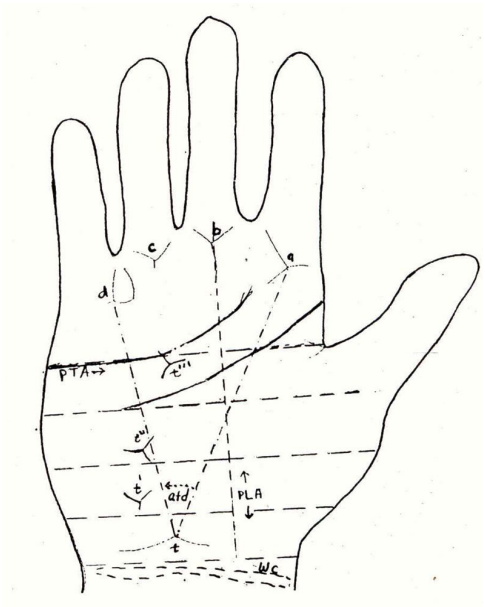



**Fig. 3:** Palm showing Position of T Triradius

## Discussion

The Main Line terminations showed varying position among the patients and controls. The following are the predominant three termination positions in the decreasing order for the D, C, B, A main lines:

There exists a significant bilateral difference among the patients for the radial / ulnar C-line terminations, where as the controls showed predominantly radial termination on both the hands.

A-line termination (Table 5) also shows statistically significant difference between patients and controls

though the order of positions remained the same for the most frequent three positions. A reduction in frequency was found at position 3 and an increased frequency at positions 4,5'and 5" among patients.

More number of controls recorded a distal position of t triradius there by showing a slightly increased atd angle among the controls than among the patients. Ranganath P et al (2004) [13] in their study titled 'Triradii of the Palm in Idiopathic Epilepsy', found a significant increase in Main line index in both hands of female epileptics and no significant difference in 'atd' angle between the patients and controls in both hands of males and females.

In this study, Ridge dissociation too presented a lower frequency among the patients as compared to the control. This is contradictory to the observations made by Brawn and Paskind (1940) [14].

The foregoing salient features and trends of dermatoglyphic parameters analyzed and compared between the patients and the controls indicate that there are differences of varying degrees as observed above, though they are not very significant statistically.

## Summary and Conclusion

*Palmar Main Lines*

i. There is a statistically significant bilateral difference in C line termination among controls as well as patients.

ii. A-line termination shows statistically significant difference between patients and controls. A reduction in frequency was found at position 3 and an increase at positions 4, 5'and 5" among patients.

*Triradius T (Number, Position and Atd Angle)*

There was no significant difference between patients and controls in the paramaters studied.

Since there were only very few studies carried out earlier showing the association between dermatoglyphics and idiopathic epilepsy, the data available for comparison was insufficient. More studies of this kind with adequate sample size are necessary to reach definite conclusions.

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