

Assessment of the Fingerprints and Palmar Crease of Stroke Patients

Iyevhobu KO ^{1,2,3*}, Asibor E ^{2,4}, Obohwemu K.O ⁵, Ken-Iyevhobu B.A^{3,6}, Usman LI ², Oseni D.I ^{3,7}, Momodu K.O ^{1,3}, Nnamudi P ^{1,3}

¹Department of Medical Microbiology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

²Department of Medical Laboratory Science, Faculty of Applied Health Sciences, Edo University Iyamho, Uzairue, Edo State, Nigeria.

³Saint Kenny Diagnostic and Research Centre, Ujoelen, Ekpoma, Edo State, Nigeria.

⁴Department of Histopathology and Cytopathology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

⁵Faculty of Health, Wellbeing and Social Care, Oxford Brookes University, GBS Partnership, Birmingham, United Kingdom; and PENKUP Research Institute, Birmingham, United Kingdom.

⁶Department of Microbiology, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

⁷Department of Chemical Pathology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria

***Corresponding Author:** Iyevhobu Kenneth Oshiokhayamhe, Department of Medical Microbiology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

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Abstract

Stroke is defined as abrupt onset of a focal neurological deficit lasting more than 24 hours. It is also called cerebrovascular accident (CVA) or apoplexy. The aim of the present study was to compare finger and palmar dermatoglyphic pattern in patients with stroke and without stroke and to determine the significant dermatoglyphic criteria applicable to the patients. The subjects for the study were 58 patients suffering stroke [CVA] who mostly attended physiotherapy session in Military Hospital Benin, Airport Road, Benin City, Nigeria. Both male and female patients were included and they were ages 43 to about 80 years. They were diagnosed with cerebrovascular accident [stroke] by medically qualified personnel in the department and their medical history obtain from the case note were used to select participant as bipolar. The patients were not related to one another but the diagnostic groups were comparable with regard to age, sex, religion, socio-economic status and ethnic origin. The mean age of the stroke patients was 71.29±1.22 years and were within the range of 43 years to 88 years. They were 48.30% female and 51.70% male. The arch finger print pattern only appears in the right thumb of the patients and was absent in the other fingers. However, the loop finger print pattern was more prevalent in the right middle and ring fingers while the whorl was more prevalent in the right index little and thumb fingers. On the left hand, the arch finger print pattern appears on the left thumb, index and ring fingers and was absent in the left middle and little fingers. However, the loop finger print pattern was prevalent in the left middle, ring, little and thumb fingers while whorl was more prevalent in the left little, ring, thumb and index finger. In the right hand the male patients were 100% arch in their thumb. The loop finger print was more in the female patients especially in the middle, ring, thumb and index finger compare to the male. The whorl appears more among the male in the index, thumb fingers while female had more in the little finger. In both palm PIC 310 was more prevalence among the stroke patients and that is its more likely to have PIC 310 on the left palm compare with the right hand. Also, on the left palm PIC 320 was absent but present on the right palm. There were 70.7% symmetrical and 29.3% asymmetrical, meaning the percentage of people having the same palm print on both palms to have stroke is higher than the percentage of those having different palm prints. In both the right and left hands, the 310 PIC was more prevalent among the stroke patients and the male subjects were more likely to present the 310 PIC compare with female in both hands. Also, in the right hand 320 PIC was absent in male and absent in left palm for both male and female. The 321 PIC was absent on the left palm of the male. Statistically, there was no significant different between the male and female in

the different PIC presented. If left untreated, stroke is a debilitating disease that can lead to death. Current statistics reflect the negative impact of unhealthy lifestyles and genetic and environmental predispositions, and the consequent burden on healthcare systems.

Keywords: fingerprints; palmar; crease; stroke; patients

Introduction

Stroke is defined as abrupt onset of a focal neurological deficit lasting more than 24 hours. It is also called cerebrovascular accident (CVA) or apoplexy (Easton et al., 2001). An acute stroke refers to the first 24-hour period of a stroke. Focal neurological deficit lasting less than 24 hours (usually 5–20 minutes) known as transient ischaemic attack (TIA). Stroke is included into medical emergency condition which becomes one of the most causes of death and disability in the world (Lopez et al., 2006; Biswas et al., 2009; Sweileh et al., 2009). Stroke kills 1 person in the world every 6 seconds, with approximately 15 million people suffer from stroke attack each year, 5 million of them dead and another 5 million suffer from permanent disability (World Stroke Organization, 2012; Kumar et al., 2015). Stroke, which is not contagious disease, is also the main cause of permanent disability (Disability-Adjusted Life Years/ DALYs) with the percentage increase that reaches almost 80% from 1990-2010 (Global Burden of Diseases (GDB), 2010). The disability (DALYs) caused by stroke in 2007 alone was estimated around 2,337,718 people lost their productive time, which is predicted to increase to 32.5% in 2020 (Suryati, 2013).

A stroke occurs when a blockage or bleed of the blood vessels either interrupts or reduces the supply of blood to the brain. When this happens, the brain does not receive enough oxygen or nutrients, and brain cells start to die. Stroke is a cerebrovascular disease. This means that it affects the blood vessels that feed the brain oxygen. If the brain does not receive enough oxygen, damage may start to occur. This is a medical emergency. Although many strokes are treatable, some can lead to disability or death. Stroke is classified on the basis of its aetiology as either ischaemic (87%) or haemorrhagic (13%) (Donnan et al., 2008). Ischemic stroke is produced by occlusion of a cerebral artery [thrombotic or atherosclerotic (50%), embolic (25%) and microartery occlusion, “lacunar stroke”, (25%)]. Haemorrhagic stroke is caused mainly by spontaneous rupture of blood vessels or aneurysms or secondary to trauma (Warlow et al., 2003).

Dermatoglyphics are the skin carvings. The term ‘Dermatoglyphics’ was coined by Cummins & Midlo (1926) and was derived from the Greek word’s ‘derma’ means skin and ‘glyphics’ means carvings (Penrose, 1963). The analysis of dermal ridges and their configurations by studying prints of them is called Dermatoglyphics (Bannister et al., 2000). The term is also used as a collective name for all the features of ridged skin. Dermatoglyphics has been studied extensively in chromosomal disorders, single gene disorders and those disorders whose genetic basis is not clear (Kiran & Hegde, 2010). They are the patterns formed by dermal ridges on the palms, fingers and soles during early intrauterine life between 7th and 21st week of gestation. During this period and only then genetic environmental factors can influence their formation. The dermal ridges and the configuration which is once formed are not affected by age, development and environmental changes in the post-natal life and so, it has the potential to predict various genetic and acquired disorders with a genetic influence (Cummins & Midlow, 1961; Bhu & Gupta, 1981).

Stroke is the second-leading single cause of disease in the world, closely behind ischaemic heart disease, and the fourth in the UK, with first-time stroke occurring worldwide every two seconds (World Health Organization, 2017). It is also one of the largest causes of disability: half of all stroke survivors have a disability and over one-third are dependent on carers (Stroke Association, 2016; Moorley, 2014). The media have played a crucial role in raising public awareness of the personal and societal consequences of stroke. Our society has become more cognisant of the function and complexity of the human brain, thanks to enhanced multidisciplinary and international communication, expanding research, increasing media coverage, and high-profile cases such as those of Andrew Marr and Sharon Stone.

Epidermal ridges and palmar creases are formed early in the intrauterine life and remain unchanged thereafter in the postnatal life of an individual. They

are affected by environmental and genetic factors in utero, and so, it has potential to predict various genetic and acquired disorders with a genetic influence (Lahiri et al., 2013). Epidermal ridge patterns show significant associations with patients of diseases with a strong or partial genetic background (Burute et al., 2013). Epidermal lines or dermatoglyphics analysis is now a valuable companion to other methods used for diagnosis of some genetic diseases and syndromes genetically determined (Kava et al., 2004).

Development of ridges was found to be affected by both genetic and environmental factors. Dermatoglyphics is accepted as a simple and inexpensive method for predicting the phenotype of a possible future illness. However, due to inherent variability of ridge pattern it is possible to arrive at any conclusion only in certain group of patients. The importance of dermatoglyphic studies in clinical medicine is that, during development, ridge formation is affected by maternal environment, gene deviants, and chromosomal aberrations. Once formed, they are age and environment stable, becoming a reliable indicator of genetic damage. Some genetically inherited diseases showing association with dermatoglyphics include mental retardation, leukemia, rubella embryopathy, Ankylosing spondylitis (Cvijeticanin et al., 2000), Essential hypertension, Systemic lupus erythematosus, congenital heart disease and Rheumatic fever, Diabetes mellitus (Rajanigandha et al., 2006), Thalassemias, Downs syndrome and Cancers such as Breast (Sridevi et al., 2010), Cervical (Vaishali et al., 2006) and Prostate (Oladipo et al., 2009). Nervous system disorders of functional ethiopathogenesis have also been positively correlated with dermatoglyphics; these include Schizophrenia and Schizotypal personality (Weinstein et al., 1999; Van-os et al., 2000). The aim of the present study was to compare finger and palmer dermatoglyphic pattern in patients with stroke and without stroke and to determine the significant dermatoglyphic criteria applicable to the patients.

Materials And Methods

Area of Study

The study was carried out at Military Hospital Benin, Edo state, Nigeria. The study essentially involved Nigerians. Nigeria is an African country on Gulf of Guinea with many natural landmarks and wildlife reserves. She has a population density of about 205 per km² and a total land area of 910,802 km². According to the National Population Commission (2006), the current population of Nigeria is 140,431,790. Edo State with Benin City as the capital is the State where the study was carried out. It has an estimated population of 3 million (NPC, 2006). The State is located in South-South geo-political zone of Nigeria, bordered by Kogi state to the North and Delta state to the East and South, Ekiti and Ondo to the West.

Materials

The materials used in this study include sphygmomanometer and stethoscope for measuring blood pressure, stamp pad as duplicating ink, white crystal bond paper, magnifying lens, soap, needle, cotton puffs, methylated spirit, water and towel.

Study Design and Sample population

A descriptive study of stroke patients. The subjects for the study were 58 patients suffering stroke [CVA] who mostly attended physiotherapy session in Military Hospital Benin, Airport Road, Benin City, Nigeria. Both male and female patients were included and they were ages 43 to about 80 years. They were diagnosed with cerebrovascular accident [stroke] by medically qualified personnel in the department and their medical history obtained from the case note were used to select participant as bipolar. The patients were not

related to one another but the diagnostic groups were comparable with regard to age, sex, religion, socio-economic status and ethnic origin.

Inclusion criteria

Participants included male and female individuals 40 years of age and above, attending physiotherapy session in physiotherapy department, Military Hospital Benin, Airport Road, Benin City, Nigeria. This sample was intended to reflect the general population of adults with varying degrees cerebrovascular accident [stroke].

Exclusion criteria

Participants who gave consent and had any distortions of fingers and palm and infected hand as well as wounds of fingers and palms prompting scars were excluded. Patients suffering from arthritis and the severely ill were also excluded in this study.

Ethical Consideration

Prior to the study, the objectives of the study were explained to the chief medical director and the head of the department where samples were obtained and a written consent was obtained. Thereafter, participants' consent was obtained after provision of adequate, clear and complete information about the study and they were asked to sign and date the written informed consent. Participants were informed that participation was voluntary and that data collected would be used mainly for research purposes. Finally, the study was performed in compliance with the Helsinki

Declaration; collected data were anonymous and were used only for academic purpose.

Sample collection

Finger print patterns were studied on the 10 fingers using a stamp ink and white A4 sheets as documented in Offei et al. (2014) with some modification. Briefly, the stamp ink was applied to the pulp area of each finger, which was then pressed on the white A4 sheets. Each finger was done one after another and labeled accordingly due to the opposing orientation of the thumb. Numbering of digit was done from thumb to little finger.

Right and left palm pictures were obtained using mobile camera with 20mp resolution as previously documented by Stelin Wersely et al. (29). Briefly, participant palms were clean, dried and gently placed side by side for a clear palm print presenting all the ridges and triradia. Pictures were printed on A4 plain papers and for purpose of confidentiality, identifying codes were used to keep participants' privacy and age and sex of the participants, and sides of the palms were recorded.

Sample analysis

Finger prints were studied with the help of a magnifying lens by grouping into the three basic pattern types as distinguished by Galton (1892) to be whorl, loop and arch. Arch pattern ridges enter from one side, traverse a pattern area, from a curve and leave from other side. Loop ridges enter on one side of the digit, recurve abruptly and leave the pattern area on the same side. Whorl is the complex pattern defined as any ridge configuration with two or more triradii (see figure 1).

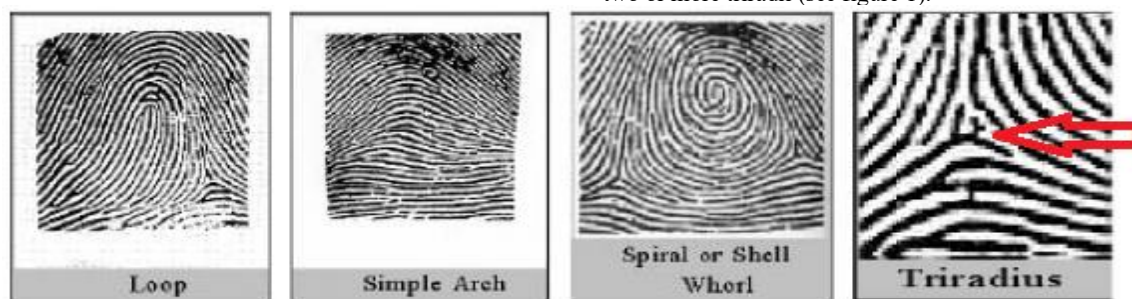


Figure 1: Patterns of finger tips

Frequency distribution indices: Pattern intensity, Furuhashi's and Dankmeijer's Indexes were calculated for the fingertip patterns according to Maltoni et al. (2009) as follows:

Pattern intensity index (PII) = $(2 \times \% \text{ whorl} + \% \text{ loop}) \div 10$

Furuhashi index = $(\% \text{ whorl} \div \% \text{ of loop}) \times 100$.

Dankmeijer index = $(\% \text{ arches} \div \% \text{ whorl}) \times 100$

Palm prints were analyzed using the number of Primary creases, Intersection of primary creases and Complete transverse crease (PIC) criteria as in Mekbebe (2019) as in figure 2.

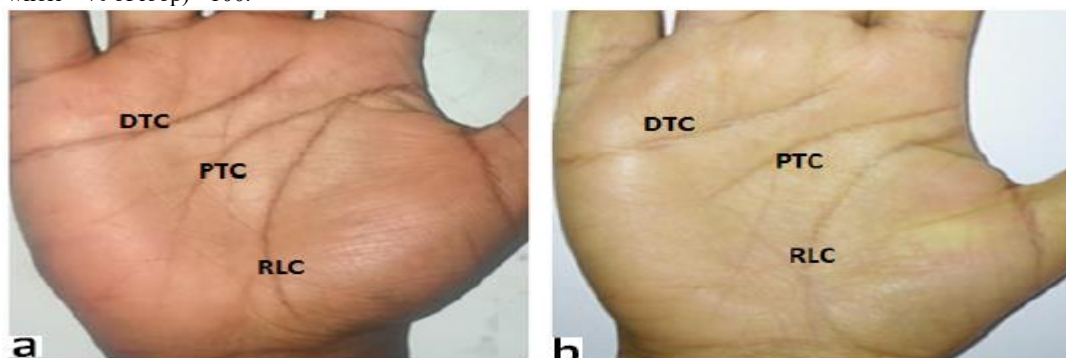


Figure 2: PIC determination of the palms

Where DTC: distal longitudinal crease; PTC: proximal longitudinal crease; RLC: radial longitudinal crease

Abnormal creases were identified based on the relationships between the PTC and DTC, as Simian, Sydney, and Suwon creases (see figure 3).

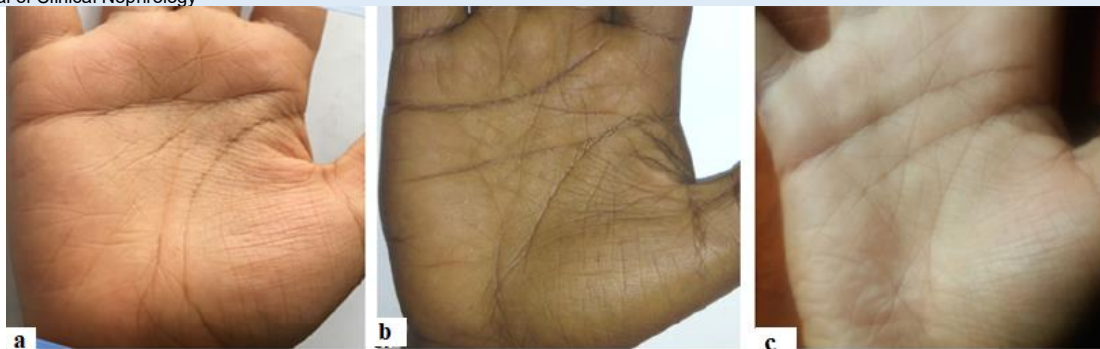


Figure 3: Abnormal palmar creases

Where (a) is Simian crease, PTC and DTC have fused and spans the entire width of the palm; (b) is Sydney crease, PTC crosses the entire width of the palm to near the ulnar border; and (c) is Suwon crease, an extended DTC that spans the entire width of the palm.

According to the manner of origins of the three primary creases on the radial side of the palm, creases were classified into one, two or three points of origin

(Chaube, 1977; Mattison et al., 2015). If both palms have same PIC profile, it was termed symmetry otherwise it was labeled asymmetry. Furthermore, each of the three major creases was studied in detail for any variants and was classified according to Park et al. (2010) as: branched, forked, accessory, broken or cascade. Identifications of palmar creases were done on both right and left hands (see figure 4)

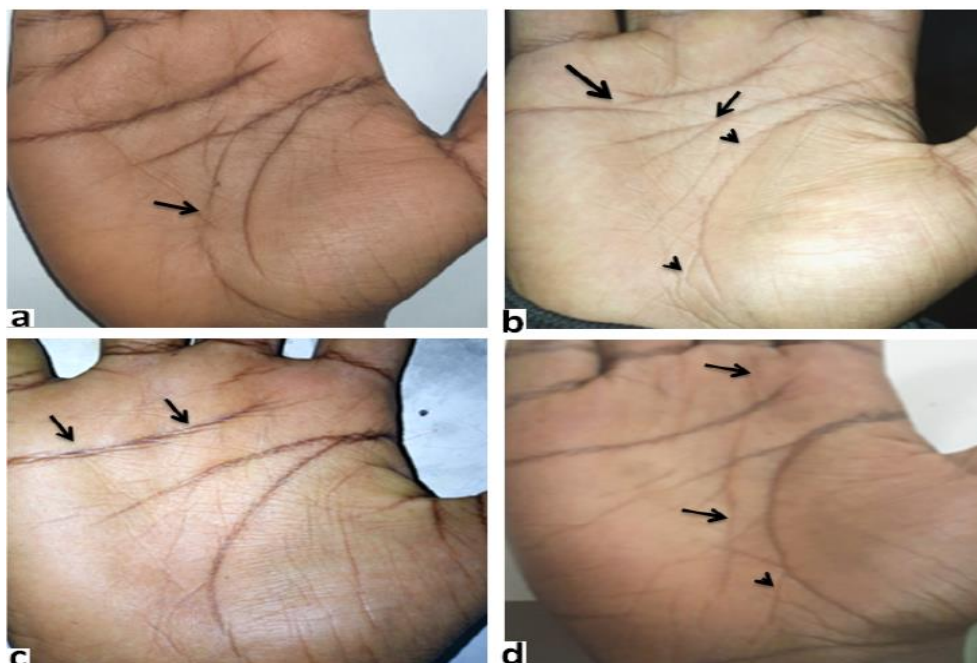


Figure 4: Variants of palm creases

Arrow in “a” shows accessory crease of the RLC. In “b” big and small arrows show, respectively broken DTC and forked PTC, while arrow heads show branches of RLC; c: cascade of DTC (arrows); d: middle finger crease (arrows) and branched RLC (arrow head);

Statistical analysis

The obtained data were entered into MS Excel and analyzed using statistical tools from Statistical Package for Social Sciences (SPSS) version 21.0. The results were compared between test and control using Chi-Square (Pearson Chi-square test and Fischer’s exact test) and Student’s t-test analysis. The

critical value for statistical significance was set at 0.05. Tables, figures and pictures were used to present the results.

Results

Demographic Profile

Table 1 shows the demographic profile of the studied population. Overall, the mean age of the stroke patients was 71.29 ± 1.22 years and were within the range of 43 years to 88 years. They were 48.30% female and 51.70% male.

	Frequency	Mean
Age	-	71.29 ± 1.22
Male	30 (51.70%)	-
Female	28 (48.30%)	-
Total	58 (100%)	

Table 1: Demographic profile of Stroke Patients.

Table 2 shows the distribution of the various finger print patterns in the right and left hands of the sampled stroke subject; the arch finger print pattern only appears in the right thumb of the patients and was absent in the other fingers. However, the loop finger print pattern was more prevalent in the right middle and ring fingers while the whorl was more prevalent in the right index little and thumb fingers.

On the left hand, the arch finger print pattern appears on the left thumb, index and ring fingers and was absent in the left middle and little fingers. However, the loop finger print pattern was prevalent in the left middle, ring, little and

thumb fingers while whorl was more prevalent in the left little, ring, thumb and index finger.

In table 3, it shows the gender differences in the distribution of the various finger print patterns in the right and left hands of the sampled stroke patients. In the right hand the male patients were 100% arch in their thumb. The loop finger print was more in the female patients especially in the middle, ring, thumb and index finger compare to the male. The whorl appears more among the male in the index, thumb fingers while female had more in the little finger.

	A (%)	L (%)	W (%)
RT	6 (10.3)	27 (46.9)	25 (43.1)
RI	-	25 (43.1)	33 (56.9)
RM	-	47 (81.0)	11 (19.0)
RR	-	45 (77.6)	13 (22.4)
RL	-	30 (51.7)	28 (48.3)
LT	5 (8.6)	32 (55.2)	21 (36.2)
LI	11 (19.0)	27 (46.6)	20 (34.5)
LM	-	42 (72.4)	16 (27.6)
LR	3 (5.2)	33 (56.9)	22 (37.9)
LL	-	33 (56.9)	25 (43.1)

Table 2: Distribution of the various finger print patterns in the right and left hands of the samples stroke patients.

Key: A – Arch finger print; L – Loop finger print; W – Whorl finger print;

RT – Right thumb finger; RI – Right Index finger; RM – Right Middle finger;

RR – Right Ring finger; RL – Right Little finger; LT – Left thumb finger;

LI – Left Index finger; LM – Left Middle finger; LR – Left Ring finger; LL – Left Little finger;

HAND	PRINTS	GENDER	THUMB	INDEX	MIDDLE	RING	LITTLE
RIGHT	Arch	Male	6	0	0	0	0
		Female	0	0	0	0	0
	Loop	Male	9	9	22	22	20
		Female	18	16	25	23	10
	Whorl	Male	15	21	8	8	10
		Female	10	12	3	5	18
		X ²	9.943	4.351	4.351	2.398	0.646
LEFT	Arch	Male	0	6	0	3	15
		Female	5	5	0	0	18
	Loop	Male	17	13	19	17	15
		Female	15	14	23	16	10
	Whorl	Male	13	11	11	10	30
		Female	8	9	5	12	28
		X ²	6.254	0.259	2.565	3.147	1.205
		P-value	P>0.05	P<0.05	P<0.05	P<0.05	P<0.05

Table 3: Gender differences in the distribution of the various finger print patterns in the right and left hand of the stroke subjects.

Palm Print Pattern of the Sample Population

Table 4 shows the distribution of the various palm print according to the point of origin, intercept and cross (PIC) patterns in the right and left palm of the sampled stroke patients. In both palm PIC 310 was more prevalence among the stroke patients and that is its more likely to have PIC 310 on the left palm compare with the right hand. Also, on the left palm PIC 320 was absent but present on the right palm.

There were 70.7% symmetrical and 29.3% asymmetrical, meaning the percentage of people having the same palm print on both palms to have stroke is higher than the percentage of those having different palm prints.

Table 5 show the gender differences on the distribution of the various palm prints according to the point of origin, intercept cross (PIC) patterns in the right and left palm of the sampled stroke subjects. In both the right and left hands, the 310 PIC was more prevalent among the stroke patients and the male subjects were more likely to present the 310 PIC compare with female in both hands. Also, in the right hand 320 PIC was absent in male and absent in left palm for both male and female. The 321 PIC was absent on the left palm of the male. Statistically, there was no significant different between the male and female in the different PIC presented.

Palm Print Patterns	Right Hand (%)	Left Hand (%)	Symmetrical (%)	Asymmetrical (%)
300 PIC	13 (22.4)	12 (20.7)		
310 PIC	34 (58.6)	43 (74.1)	41 (70.7)	17 (29.3)
320 PIC	5 (8.6)	-		
321 PIC	6 (10.3)	3 (5.2)		

Table 4: Distribution of the various palm print according to PIC patterns in the right and left palms of the sampled stroke subjects.

Palm Print Patterns	Right Hand		Left Hand	
	Male	Female	Male	Female
300 PIC	8	5	5	7
310 PIC	19	15	25	18
320 PIC	0	5	-	-
321 PIC	3	3	0	3
X ²	6.101		4.409	
P-value	P>0.05		P>0.05	

Table 5: Gender difference in the distribution of the various palm prints according to the point of origin, intercept cross (PIC) patterns in the right and left palm of the sampled stroke patient.

Discussion

Stroke is the second leading cause of death and contributor to disability worldwide and has significant economic costs. Thus, more effective therapeutic interventions and improved post-stroke management are global health priorities. The last 25 years of stroke research has brought considerable progress with respect to animal experimental models, therapeutic drugs, clinical trials and post-stroke rehabilitation studies, but large gaps of knowledge about stroke treatment remain.

Dermatoglyphic data has long been recognized as valuable genetic marker both in the study of population relationships as well as in clinical studies. Because of their inherent advantages over other biological markers, dermatoglyphics have been utilized by investigators from a number of different scientific disciplines. The examination of dermatoglyphics does not involve physical pain or economic burden for patients (Stough & Seely 1969). The other most important parameter of dermatoglyphics is the inheritance. All the physical features of the human body including the dermatoglyphics are inherited as per the laws propounded by Mendel.

In this presence study the dermatoglyphic parameter in stroke patient with mean age 71.29 ± 1.22 where determine and weather the parameters can be used for screening purpose in early detection of stroke. The overall mean age of the stroke patients was 71.29±1.22 years and were within the range of 43 years to 88 years. They were 48.30% female and 51.70% male (Table 1). The arch finger print pattern only appears in the right thumb of the patients and was absent in the other fingers. This is in line with K M Godfrey who studied dermatoglyphics of hypertensive patients and found that arches were least common in the study group (Oladipo et al., 2010). However, the loop finger print pattern was more prevalent in the right middle and ring fingers while the whorl was more prevalent in the right index little and thumb fingers. On the left hand, the arch finger print pattern appears on the left thumb, index and ring fingers and was absent in the left middle and little fingers. However, the loop finger print pattern was prevalent in the left middle, ring, little and thumb fingers while whorl was more prevalent in the left little, ring, thumb and index finger (Table 2). In the right hand the male patients were 100% arch in their thumb. The loop finger print was more in the female patients especially in the middle, ring, thumb and index finger compare to the male. The whorl appears more among the male in the index, thumb fingers while female had more in the little finger (table 3). This is almost in agreement with a study of K M Godfrey on dermatoglyphics of hypertensive patients found that whorls were second most common in the study group (Oladipo et al., 2010).

In this study, the distribution of the various palm prints according to the point of origin, intercept and cross (PIC) patterns in the right and left palm of the sampled stroke patients, it was discovered that in both palm 310 PIC was more prevalence among the stroke patients and that is its more likely to have 310 PIC on the left palm compare with the right hand. Also, on the left palm 320 PIC was absent but present on the right palm. There were 70.7% symmetrical and 29.3% asymmetrical, meaning the percentage of people having the same palm print on both palms to have stroke is higher than the percentage of those having different palm prints (Table 4). This finding correlates with other population studies (Wu et al., 2004; van Mensvoort, 2009) suggesting that the current results could be a reflection of the prevalence of the symmetrical palmprint in the population. In assessment of the gender differences on the distribution of the various palm prints

according to the point of origin, intercept and cross (PIC) patterns in the right and left palm of the sampled stroke subjects, it was observed that in both the right and left hands, the 310 PIC was more prevalent among the stroke patients and the male subjects were more likely to present the 310 PIC compare with female in both hands. Also, in the right hand 320 PIC was absent in male and absent in left palm for both male and female. The 321 PIC was absent on the left palm of the male. Statistically, there was no significant different between the male and female in the different PIC presented (Table 5). Thus, with the available data and statistical analysis, dermatoglyphic patterns may be used as a reliable indicator for scientific screening of population prone to stroke.

Conclusion

If left untreated, stroke is a debilitating disease that can lead to death. Current statistics reflect the negative impact of unhealthy lifestyles and genetic and environmental predispositions, and the consequent burden on healthcare systems. Dermatoglyphic investigation is very cost effective and requires no hospitalization. In clinical medicine, the importance of dermatoglyphics is that it can help in predicting the phenotype of a possible future illness. The most disturbing trend is the shift in age of onset of stroke to a younger age in the recent years. This could have long lasting adverse effects on nation's health and economy. Early identification of at-risk individuals using simple screening tools like dermatoglyphics which is user friendly; economically viable would greatly help in preventing or postponing the onset of diabetes and thus reducing the burden on the community and the nation as a whole. The dermatoglyphic features of the present study may be used as a suggestive diagnostic tool to make a provisional diagnosis and to identify the persons who are at risk, but it requires more extensive studies in a large number of patients.

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