CHAPTER-III

MATERIAL AND METHODS
Cancer is a group of many related diseases. All forms of cancer involve uncontrolled growth and spread of abnormal cells. Cancer is rapidly emerging as one of the most common forms of disease among Indians. Moreover, the high cost of diagnosis and treatment is affecting the prevention and the management of this disease. Therefore, besides clinical observations some other additional cost effecting tool for the diagnosis of cancer may be desirable. Dermatoglyphic study is one such tool. The present study is mainly concentrated on three types of cancer such as, Mouth Cancer, Breast Cancer and Prostate gland Cancer. The above mentioned types of cancer are the most commonly found among the human beings.

The material for the present study consists of bilateral palmar prints of cancer patients, which were collected from different hospitals in Madhya Pradesh (Fig.1). The name of the hospitals are as follows:

1. Jawaharlal Nehru Cancer Hospital and Research Centre, Idgah Hills, Bhopal.
2. Padhar Hospital, Betul.
3. Govt. S.G. Cancer Hospital, Indore.
4. Indore Cancer Foundation Charitable Trust Pigmamber, Rau, Indore.
5. Cancer Care Trust & Research Foundation, Indore.
6. Christian Hospital, Indore.
Fig. 1. Map of Madhya Pradesh: Location of the Study Area.
The data were collected on three types of cancer which includes bilateral palmar prints of cancer patients. The sexwise details of the cancer patients are given in the table.

<table>
<thead>
<tr>
<th>Types of Cancer</th>
<th>Number of individual cancer patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Mouth Cancer</td>
<td>40</td>
</tr>
<tr>
<td>Breast Cancer</td>
<td>-</td>
</tr>
<tr>
<td>Prostate Gland Cancer</td>
<td>61</td>
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</table>

The bilateral palm prints were also collected in an equal proportion from 174 normal unrelated children (Male=101; Female=73) to be used as control group. The data for the control group was collected from Sarswati Shishu Mandir, Harda (M.P.). For the present study patients and control (normal) group were selected on the Brahmin caste.

**BASIC CRITERIA FOR THE SELECTION OF THE PATIENTS**

The patients were selected according to the following criteria.

1. The patients (Male and Female) were selected from the Brahmin caste only.

2. Only those patients who were diagnosed by the registered medical practitioner of the hospital for a particular type of cancer, have been taken in the present study.
BASIC CRITERIA FOR THE SELECTION OF THE CONTROL

The normal children (Male and Female) for the control group were selected according to the following criteria

1. The normal children were selected from the Brahmin caste only.
2. The normal children of different age groups were included in the present study.
3. The close relatives (consanguineous kins) of an individual were avoided.
4. Families with genetic disorders were excluded from this study.

The material used during taking the prints are very few, but a little skill is needed to obtain good prints. The material used during data collection are spirit, soap, water, towel, glass slab, gestetner’s duplicating ink, cotton pad, printing paper, magnifying glass and a sharp pencil. Before taking prints the palm of the subjects are washed with soap and water, and then after drying, the palms are treated with cotton soaked with spirit to ensure quality prints. A small amount of ink is taken on the glass slab and spreaded over the surface by a roller, and smeared into a thin uniform film. The pad is then puffed smoothly on the glass, care has to be taken during inking the pad. Then the ink is applied on the subjects palm using a light pressure, the palm is then rolled downward with the bracelet creases touching the paper first followed by the palm. The palm is pressed firmly against the paper, pressure is exerted particularly over the two central
areas of the palm and over the knuckles and interdigital areas to ensure printing of mid-concavity and uneven surfaces of the palm. Then the palm is rolled in radio-ulnar direction to lift it of the paper without disturbing the print. After obtaining good prints, they are examined with the help of lens. The various patterns are located by a sharp and pointed pencil.

In the analysis of the palm prints the following qualitative and quantitative parameters are included and the analysis will be done as the Internationally accepted methods adopted from Cummins and Midlo (1961) with some modification.

The parameters in the present study which are studied as follows – principal main line formula, termination of main lines pattern types on configuralional areas, position of axial triradius, \( \angle \) trid angle, ridge counts between interdigital triradii and the main types and their subtypes of palmar flexion creases.

**ANALYSIS:**

The palmar area is divided into six dermatoglyphic areas. These are-Hypothenar, Thenar and four Interdigital areas. At the base of the digit II, III, IV and V, there is normally found a triradius. Those four triradii are designated as a, b, c and d.

**MAIN LINES:**

The proximal radiants of the digital triradii a, b, c, d are called main lines and are labeled A, B, C and D, coinciding with the digital
triradii of the same letter. Tracing the flow of main lines to their point of termination reflects the general direction of flow of the palmar ridges. The main-lines of the palm A, B, C, D and the scheme number for formulating palmar main-lines are illustrated in Figure 2.

**CONFIGURATIONAL AREAS:**

**Hypothenar**: This area is a proximal hypothenar pad and approximately it is bounded on its radial side by a line drawn from the base of the ring finger to the position of the palmar border. Normally three primary type of true patterns viz. Whorls, loops and tented arches are found in this area. In the present study only the presence of true patterns have been analysed. In the absence of the true patterns the area is designated as open field.

**Thenar/Interdigital I**: The configuration of the thenar/I interdigital areas are closely related anatomically. In these two areas varieties of pattern combinations are present. But in the present study only the true patterns are considered.

**Interdigital II, III and IV**: The configurational area lying between triradius a and b is interdigital II, lying between b and c is interdigital III and laying between c and d is interdigital IV. In these areas mainly the whorls, loops and vestiges are seen but the most common pattern present in this area is loop. Here only the true patterns and open field are taken into account.
FIG. 2: Anatomical Landmarks on Palmar Region
PATTERN TYPES:

In each of configurational areas a pattern may be found or if the ridges flow parallel to one another, an open field or patternless area is formed. A vestige pattern consists of ridges which differ in orientation from surrounding ridges but fail to form either a loop or a Whorl. Various researchers have proposed schemes for the classification of pattern types. Gatton (1892) gave the whorl-loop-arch classification for personal identification and for some biological investigations. In Henry's (1937) classification there are four main types of patterns—arches, loops, true whorls and composites. Henry's system of pattern classification is more widely used than the classification of other researchers.

ARCH:

An arch is a simple pattern which is formed by more or less parallel ridges. These ridges transverse and form a curve which is concave proximally. The arches are of two types simple and tented arches. The simple arch has no triradius and the tented arch is of a tent-like structure. It has one triradius in the middle region of the ridge direction.

LOOP:

The loop pattern is simpler in constitution than the whorl and consists of only one triradius. Loops are sub divided into two main
types radial loops (R) and ulnar loop (U) according to the direction that the loop flows on the hand.

A. **Ulnar Loop (U)**: Where the ridges flow or terminate in the direction of ulnar bone of the forearm.

B. **Radial Loop (R)**: Where the ridges flow or terminate in the direction of radius bone of the forearm.

**WHORL**

A whorl is characterized by a circular pattern having one or more ridges revolving around the core and making a complete circuit. The whorl is that type of pattern in which at least two triradius are present with a re-curve in front of each other. The whorls can be classified into two types - True whorls and Composite whorls.

A. **True Whorl**: Typically possess two tri-radii and they are patterns so constructed that the characteristic ridge course follow circuits around the core. It includes the following sub types:

(I) **Whorl Single Spiral (W_s)**: The arrangement of the ridges follow single spiral course, clock-wise or anti clock-wise.

(II) **Whorl Double Spiral (W_d)**: The ridges follow double spiral course from the core.

(III) **Whorl Concentric Circles (W_c)**: The ridges follow a circular conformation in the immediate neighborhood of the core.

B. **Composite Whorl**: There are compound patterns in which two or more designs, each conforming to the general aspect of one of the
simpler types are combined in one patterns area. Two or more tri-radii are present. There are four types of composites:

(I) **Whorl Central Pocket** (W<sup>cp</sup>): A whorl of reduced size inside a pattern area similar to loop.

(II) **Whorl Lateral Pocket** (W<sup>lp</sup>): The lines traced from the core emerge on the same radial or ulnar margin.

(III) **Whorl Twin Loop** (W<sup>t</sup>): The lines traced from the core emerge on opposite margins.

(IV) **Whorl Accidental** (W<sup>acc</sup>): There are complex patterns, formed by combination of two or more usually unrelated configuration types - a whorl and a loop, a tend arch and a loop, triple loops and other bizarre configurations not assignable to the standard types.

The various subtypes of arch, loop and whorl are diagrammatically represented in the Fig. 3.

**AXIAL TRIRADIUS:**

The Axial triradius(t) is usually found at the base of the palm, commonly in the depression between the thenar and the hypothenar eminences. Occasionally two or even three, axial triradii may be present. A triradius located near the centre of the palm is designated by the letter t". A triradius present on the base of the palm is denoted as t and an intermediate triradius situated between t and t", is denoted by the symbol t'.
<table>
<thead>
<tr>
<th>1. ARCH</th>
<th>2. TENTED ARCH</th>
<th>3. ULNAR LOOP</th>
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<tbody>
<tr>
<td>![Arch Pattern]</td>
<td>![Tented Arch Pattern]</td>
<td>![Ulnar Loop Pattern]</td>
</tr>
<tr>
<td>4. WHORL SINGLE SPIRAL</td>
<td>5. WHORL DOUBLE SPIRAL</td>
<td></td>
</tr>
<tr>
<td>![Whorl Single Spiral Pattern]</td>
<td>![Whorl Double Spiral Pattern]</td>
<td></td>
</tr>
<tr>
<td>6. WHORL CONCENTRIC CIRCLES</td>
<td>7. WHORL CENTRAL POCKET</td>
<td>8. WHORL LATERAL POCKET</td>
</tr>
<tr>
<td>![Whorl Concentric Circles Pattern]</td>
<td>![Whorl Central Pocket Pattern]</td>
<td>![Whorl Lateral Pocket Pattern]</td>
</tr>
<tr>
<td>9. WHORL TWIN LOOP</td>
<td>10. WHORL ACCIDENTAL</td>
<td></td>
</tr>
<tr>
<td>![Whorl Twin Loop Pattern]</td>
<td>![Whorl Accidental Pattern]</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3: Different Type of Patterns.
ANGLE $\angle \text{atd}$:

An angle drawn with apex at $t$ triradius and arms ending at the $a$ and $d$ digital triradii forms the $\angle \text{atd}$ angle. If two or more axial triradii are present, the most distally placed is selected and used to calculate the maximum $\angle \text{atd}$ angle.

PALMAR RIDGE COUNTS:

The digital triradii $a$, $b$, $c$ and $d$ were located and marked on the prints and than connected by a fine straight line between $a-b$, $b-c$, $c-d$ and $a-d$. All the ridges crossing or touching the line (except the interstitial ridges) were counted by the help of a magnifying glass.

Palmar ridge counts have not been studied as extensively as finger ridge counts. Borecki et al., (1985) reviewed some of the studies on palmar ridge counts and brought forth the conclusion that palmar ridge counts were thought to be compatible with polygenic mode of inheritance. Faug (1950) and Pons (1964) have clearly pointed out the significance of the palmar ridge count as a better tool in ethnic evaluation.

PALMAR FLEXION CREASES:

Palmar flexion creases are not the components of dermatoglyphic but they are important because of peculiarities of epidermal ridges coursing in them. (Cummins and Midlo, 1961).
The first scientific approach in the field of creases was made by Paul Broca (1866) and this was later followed by Longdon-Down (1909), Crookshank (1924), Rittneister (1936) and many others.

The first systematic crease formulation was the orientation of the simian crease. The classification of Pouch (1925) included all types of transverse and longitudinal creases. His formulation is based on the relative position of these creases. In this direction, the important simian crease oriented formulations are given by Potius (1937), Weninger and Navratil (1957), Buchi (1954), Poch (1925), Kimura (1968), Gyula and Gyorgy (1971), Vijay Bhanu (1972).

To analyse the palmar flexion creases the method evolved by Bali and Choube (1971) has been followed in the present study. This method eliminates the possibility of genetic diversity between various creases.

Bali and Choubey classified the main flexion creases distal transverse crease, proximal transverse crease and radial longitudinal crease on the basis of their origin from a common point which they referred as radial base point (Fig. 4). On the basis of this point the palmar creases could be classified into the three main categories:

**S.** Single radial base crease (SRBC)

**D.** Double radial base crease (DRBC)

**T.** Triple radial base crease (TRBC)
Fig. 4. Palmar Flexion Creases

Fig. 5. Subtypes of Single Radial Base Creases (SRBC)

(a) Distal Double Radial Base Creases
(b) Proximal Double Radial Base Crease

Fig. 6. Subtypes of Double Radial Base Creases (DRBC)

Fig. 7. Subtypes of Triple Radial Base Crease (TRBC)
This classification signifies the base point of crease origin, i.e., when the creases originate from a single base point on the radial side they are called single radial base crease. When they originate from the double base points on the radial side are called double radial base crease when originate from the triple base points are called triple radial base crease thus, eliminating the need for keeping simian crease as the mark of crease classification of the palm.

These main types of creases (SRBC, DRBC, TRBC) are again classified into other subtypes depending upon the initial split of transverse crease.

The single radial base creases (SRBC) is again divided into five subtypes $S_1$ to $S_5$ (Fig. 5).

1. $S_1$ is the condition where the distal transverse crease and the proximal transverse crease are overlapped by one another and can not be distinguished.

2. In $S_2$, the proximal transverse crease, after covering some distance with the distal transverse crease, splits up towards the proximal side of the palm.

3. In the $S_3$ subtype, all the three creases, though meeting at the common base point of origin, becomes separate from the radial base point, that is the point of origin.
4. In S₄, all the three creases have a common base but the distal transverse crease splits up towards the distal side, and the proximal transverse crease splits up - towards the proximal side of the palm.

5. In S₅, the splits of the distal transverse crease meets the proximal transverse crease and covers the distance of the palm with the proximal transverse crease.

The double radial crease could further be classified into two main groups on the basis of its distal proximal position. The distal double radial base crease makes the base together with that of the distal transverse crease and the proximal transverse crease, while the proximal double radial base crease makes the base with the union of the proximal transverse crease and the radial longitudinal crease. Each group is again divided into three types from D₁ to D₃, and D₄ to D₅ (Fig. 6).

1. **D₁** is the condition when the proximal transverse crease and the distal transverse crease are overlapped by one another and cannot be distinguished, but there are two points of origin. This is also the case of the perfect simian crease.

2. In the **D₂** type, the proximal transverse crease runs with the distal transverse crease upto some distance and then splits up towards the proximal side of the palm.
3. In the $D_3$ type, the proximal transverse crease and the distal transverse crease are connected with each other by a segment.

4. In the $D_4$ type, the proximal transverse crease meets (makes the union) the radial longitudinal crease at a point on the radial base point, i.e., the point of origin.

5. In $D_5$, the proximal transverse crease runs with the radial longitudinal crease upto some distance and than splits uptowards the proximal side of the palm.

6. In $D_6$, the proximal transverse crease emerges from the radial longitudinal crease and deviates towards the proximal side of the palm. The sub types of the triple radial base crease have not been found so far. All the three creases i.e. distal transverse crease, proximal transverse crease and radial longitudinal crease, have independent points of origin.

The subtypes of triple radial base crease has not been reported so far (Fig. 7).

**STATISTICAL CONSIDERATION:**

In the present study univariate statistical Chi-square test ($\chi^2$ test) has been used to observe the variations between the cancer patients and the control group.

**Mean**: It is the most commonly used estimation of average. It is calculated by adding all the value of the variable and dividing the sum by total number of values.
Mean,

\[ \bar{x} = \frac{\Sigma x}{N} \]

Where \( \Sigma x \) is the total of all the values and \( N \) is the sample size.

**Test of the significant:** If two populations are alike in regard to certain variables, then statistical test can be applied to examine their significance. This test is termed as test of significance. Only one test is used in this study and this is the Chi-Square test.

**Chi-square test (\( \chi^2 \) test):** This test of significance is found useful in computing the difference in regard to non-metric data. The formula for the computation of the conventional chi-square test is as follows:

\[ \chi^2 = \frac{(\text{Observed value} - \text{Expected value})^2}{\text{Expected value}} \]

**Degree of freedom (d.f.):** The degree of freedom can be found by this formula:

\[ \text{d.f.} = (\text{No. of rows} - 1) \times (\text{No. of columns} - 1) \]

The value of \( \chi^2 \) is seen in the probability table against the degrees of freedom. If the value of probability is found to be either equal or more than 0.05, it is taken to be mean and then, there is no statistical difference as far as that parameter is concerned.