

MSA

Uph 3/11/100

# Forensic Anatomy

Roll no 63

“Forensic Anatomy is the application of standard specific techniques of physical anthropology to the solution of matters of public concern”

## Objectives of Forensic anatomy

- 1) Age
- 2) Sex
- 3) Race
- 4) Stature
- 5) Poisoning
- 6) Time since death

## Establishment of human identity of bones

The following information can be obtained from skeletal remains.

- 1) Whether human or not
- 2) Commingling
- 3) Age
- 4) Sex
- 5) Race
- 6) Stature
- 7) Time since death
- 8) Osteopathology

# 1) Whether human or not

## a) Gross Examination

Skull is the differentiating bone between human and related species as all other bones of human are closely related to other species.

## b) Microscopic Examination

- In the long bones of mammals haversian system is more prominent ~~than osteoid material~~.
- In non mammalian bones pneumatic bones (air spaces structures) are present.

## c) Antigen – antibody precipitin test.

- It is the test used to determine if the blood is human or not.

### Principles of precipitin test.

- Human blood is injected into a rabbit in response to which antibodies are formed, following which the rabbit's blood is extracted as an antiserum.
- The antiserum is placed on suspected sample blood
- If sample is positive for human blood then it will react with human proteins and a cloudy precipitate will form where the two layers meet.

## 2) Commingling

Bones of different skeletons are mixed together (sorting out)

## 3) Determination of age

Age span begins with conception within uterus and after birth passing through stages, ends with death.

### a) Proliferative phase (from conception to 25 years)

It has two distinct stages

- Intrauterine phase
- Extrauterine phase

### b) Static phase (from 25 years to 44years)

### c) Retrogressive phase(44 years onward)

## Examination of Age

It includes the study of :

- a) Complexity of body
- b) Skeletal data
- c) Dental data

### **a) Complexity of body**

It includes weight, length and other characteristics of body.

### **Hess's Rule**

Squares of months of gestation gives the length of fetus upto 5<sup>th</sup> months.

After this number of months are multiplied by five that gives length of fetus in centimeter (Cm).

### **b) Dental Data**

Determine of age from dental data depend upon stage of tooth development, which has two periods.

>Pre natal

>Post natal

#### **Pre-Natal:-**

- Calcification of tooth starts in incisor at the tip of milky teeth at 5<sup>th</sup> month of IU life.
- From 20<sup>th</sup> week onward process of calcification in the tip of remaining teeth start
- At the time of birth the process of calcification have progressed to an extent of 2/3<sup>rd</sup> in incisor 1/3<sup>rd</sup> in the canines & just tips in molars.

## POSTNATAL

- Deciduous Teeth:-

<u>Age</u>	<u>Teeth</u>
6-8month	Lower central Incisor
7-9month	upper central Incisor
9month	upper lateral
10month	lower lateral
12month	1 <sup>st</sup> molar
18 month	Canines
2year	2 <sup>nd</sup> molar

- Permanent teeth

<u>Age</u>	<u>Teeth</u>
6year	1 <sup>st</sup> molar
7year	Central incisor
8year	Lateral Incisor
9 <sup>th</sup> year	1 <sup>st</sup> Bicuspid

10 <sup>th</sup> year	2 <sup>nd</sup> Bicuspid
11 <sup>th</sup> year	Canines
11-12year	2 <sup>nd</sup> molar
17-18year	3 <sup>rd</sup> molar

• **Gustafson's criteria**

Age estimation from dental data over 25 years of age

1. Degree of attrition
2. Alternation in the level of gingival attachment
3. Amount of Secondary dentine
4. Translucency of root ( most reliable )
5. Cementum deposits around the root
6. Periodontosis

c) **Skeletal Data**

\* At birth ossification centers are present in.

- Lower end of femur
- Cuboid
- Talus
- Clavicle
- Calcaneum

*M, C, I, Q, D*

*8-9 m*

\* 1-2 years :

- Anterior fontanelle should be closed

\* 2-6 years :

- Number of Carpal Bones.

\*by 4years (females) and 6years (male):

- Medial epicondyle of humerus

\*8-10years:

- Olecranon

\*10-12years :

- Pisiform bones is ossified.

\*15-16years:

- coracoid process of scapula fuses with main bones.
- Olecranon process fuses with ulna .
- Head of metacarpals fuse with respective shaft.

\* 16-18 years:

- All bones of Arm and Forearm fuse at elbow
- Head of femur fuses
- Lower end of tibia fuses

\*18-20year:

- All bones are fuses at wrist, lateral end of Clavicle as well as crest of ileum fused.
- Acromion process united to scapula.

\* 21-22years:

- \*Ischia tuberosity fused.

\*14-25years:

- Three parts of body of sternum fuse with each other from below upward.

\*40 years:

- Xiphoid process fuses with body of sternum.

\*60 years:

- Manubrium fuses with the body of sternum.

\*Coronal suture fuses at 35-40years.

\*Sagittal suture fuses at 30-35years.

\*Lambdoid suture fuses at 40-45years.

\*Lipping of vertebrae is above 40 years.

**\*The areas which are routinely X-rayed to determine the age of a person are:**

- **Wrist and hand in children**
- **Elbow, shoulder, pelvis and knee in adults, and**
- **Skull, vertebrae, and sternum in old people**

#### **4) Determination of sex**

Morphological characteristics of bones are used to differentiate b/w sex.

##### **Skull**

<b><u>Feature</u></b>	<b><u>Male</u></b>	<b><u>Female</u></b>
Size	large	Small

Architectures design	Rugged	Smooth
Orbit	“Smaller, with round margins	“Rounded, larger, sharp margins
Supra-orbital Ridge	Medium large	Small medium
Cheek bone	Large and laterally	large
Forehead	Steeper, less rounded	more rounded
Mandible	Larger broader U-Shape	Small narrower and parabolic

## Sacrum

### Features

### Male

### Female

Size	large, less wide and heavy	Short, more wide and light weight.
Curvature	It acts as uniform curve	Almost straight upper part and curve at lower part.
Articulating surface	Articular surface extends upto third	Articular surface extends

vertebrae

upto second  
vertebrae

- **Pelvis:**

**Feature**

**Male**

**Female**

Whole Pelvis

Massive & Roughed

Less Massive &  
less roughed.

Supra public angle

Acute and V-shaped

Round, Broad  
V-Shape

Symphysis

Higher

Lower

Ilium

Higher & tend vertically

Lower &  
tends laterally

Sacrum

Larger & Narrower

Smaller & Broad

Pelvic Brim

Heart Shape

Rounded

Pelvic cavity

Small

Oblique & Shallow

- **Long Bones:**

These are heavier and long in male as compare to female.

### 5) **Determination of Race**

It can be determined from clothes, complexion, hair, Eyes, lips.

There are three types of Races

- Black (Negros)
- Europeans
- Mongols

Cephalic index

*Important in race determination*

Max. Transverse Breadth of skull x100

Anterio -posterior length

Max. transverse breadth = from one mastoid to other.

Anterio – posterior Length = Between glabella and external occipital protubance.

Skull	Index
Dolicho-cephalic= long headed (Blacks)	70-74.9
Mesati-cephalic= Medium headed	75-79.9
Brachy-cephalic: Short headed	>80 & above

Height Index

Height Index =  $\frac{\text{Height of skull}}{\text{length of skull}} \times 100$

Height of skull = from mastoid to Bregma

Blacks = 72

Europeans = 71

Mongols = 75

## Nasal index

$$\text{Nasal index} = \frac{\text{Width of nasal aperture} \times 100}{\text{Height of nasal aperture}}$$

Blacks = 55

Europeans = 46

Mongols = 50

## Teeth

- Start shaped configuration to molar in blacks.
- In Mongolians upper central incisors teeth are shovel shape.

## Radio humeral index

$$\text{Radio-humeral index} = \frac{\text{Length of radius} \times 100}{\text{Length of hummers}}$$

Europeans = 75

Mongols = 75-80

Blacks = Above 80

## Tibio - Femoral index

$$\text{Tibio- femoral index} = \frac{\text{Length of Tibia} \times 100}{\text{Length of femur}}$$

- **Amino acid content**:-

By auto analyzer upto 20 amino acids are detected in bones, they decline gradually in number and conc after death.

- **Blood pigments**:-

Remnants of blood pigments are also used to determine time since death.

Periodical surface may be used for test area.

- **Fluorescence**:-

Light crosses whole surface of long bone. If section of bone is kept under dark & examined under UV light. Recent bones will shine with silvery blue tint, while in ancient bones fluorescence vanishes with time.

- **Immunological activity** :-

Bones extracts when tested against anti-human sera give visible antigen antibody reaction used in determination of time since of death.

- **Electron microscopic examination**:-

It is also used to determine time since death in

- **Radioactive carbon (C14)** :-

All living things absorb carbon from air and loose it after death at its specific rate. Therefore it can be used to determine time since death.

Europeans = Less than 83

Blacks = more than 83

Mongols = in between the above mentioned

## 6) Determination of Stature:

- If complete stature is available:

Stature = Length of skeleton + 2.5cm thickness of  
soft parts

- If mutilated

Stature =

- 1) Length from tip of middle finger to the tip of opposite middle finger when arms are fully extended.
- 2) Pubic symphysis from central part of body (from 20<sup>th</sup> or 25<sup>th</sup> year onwards)
  - \* Upper body (vertex to body pubic Symphysis x 2)
  - \* Lower body (pubic symphysis to heel x 2)

- Anthropometry:

“Scientific study of the measurement and proportions of human body”

Different body parts grow upto 21 years of age.

### 7) Dating of bones/Time since death.

It is done for comparison of growth pathology and determination of time since death. Medico- legally bones are examined to know whether the bones are recent or ancient.

Examination is done subjective and objective means.

- **Subjective examination:**

Morphological appearance is modified by environment factors as

Temperature

Humidity

Dry and wet soil

Recent bones 10-20 years old are greasy and retain their soft tissues.

Ancient bones are dry, brittle and light weight .

### **Objective examination**

It is done by following physical and chemical means.

- **Nitrogen content** :-

For collagenous stroma. Newborns contain 4- 4.5g of Nitrogen and decline gradually after death.

## 8) Osteopatholgy

If any disease is detected in one bone and there is previous history of such diseases in missing person then demonstration of these diseases in other bones of skeleton is supportive evidence for the identification of individuality

For example

Endocrinal (Acromegaly)

Nutritional (Rickets)

Bone disorder (Paget's Disease)

Acquired diseases (Osteoprosis)