Department of Forensic Medicine, University of Dundee

Lecture Notes

Identification

Identification of the living
Identification of the dead
Primary & Secondary Physical Characteristics
Skeletal remains (determination of sex, race, stature, age, dating skeletal remains)

IDENTIFICATION OF THE LIVING

Primarily a matter for police investigation.

METHODS OF IDENTIFICATION

1. **Personal impression (visual identification)**
   Basis of identification parades but is notoriously unreliable. Witness in court may be asked to point out the accused. Identikit is a composite picture of a person from a witness account. Personal impression depends on features such as hair, moustache and beard, all of which can be changed easily. Plastic surgery can easily alter other features.
2. **Photography**
   More useful in identifying the living than the dead.
3. **Handwriting**
   Possible for experts to identify a person (or detect forgeries). Methods used include photographic enlargement, analysis of ink, analysis of paper.
4. **Fingerprints (Dactylography)**
   How fingerprints are produced: friction skin (i.e. palms and soles) have a ridge pattern. Sweat glands open through minute openings on the summits of the ridges. The sweat contains fat. When the skin is applied to a smooth surface a greasy impression is left behind. The impression can be developed by suitable dusting powder (or even simply by breathing on it but then it is only transient). Impression can be "lifted" after development. Impressions remain for years is undisturbed by cleaning.

   Principles of fingerprint identification: fingerprint patterns are unique (1 in 64 billion chance of 2 prints being identical). FBI has over 100 million records, no two of which are alike. Fingerprint pattern of an individual remains unchanged throughout life. Reversible atrophy occurs in certain diseases (coeliac disease, dermatitis). Permanent impairment occurs in leprosy and after exposure to radiation. Attempts to mutilate fingerprints are sometimes made. If only the epidermis is destroyed there is no alteration in ridge pattern. If dermis is destroyed additional points of identification are created.

IDENTIFICATION OF THE DEAD

Primary Physical Characteristics
(*characteristics which are very difficult for a person to change during life.*
Some of these characteristics will appear to alter post mortem):

- Sex - usually obvious.
- Age - external appearances, internal degenerative disease, bones, joints.
- Height or stature - N.B. height of corpse differs from that in life by up to 2-3 cm, due to joint and muscle relaxation
- Weight - corpse often appears of different build to that in life
- Race
- DNA (unique to every individual. Considered in detail in the lecture notes on Genetics & Parentage Testing)

Secondary Physical Characteristics
(characteristics which can change during life, either deliberately by deceased or as a result of medical/dental interference.
Some of these characteristics will appear to alter post mortem):

- Skin colour (alters post mortem)
- Eyes - more useful in caucasians than negroid & mongoloid races. Colour can alter PM
- Teeth - very resistant and bear much useful information.
- Hair - colour, style, length, beard/moustache.
- Scars - surgical procedures and prostheses.
- Tattooing - seen even if the body is putrefied.
- Fingerprints
- External peculiarities - circumcision, moles, warts.
- Deformities
- Clothing and other objects
- Jewellery
- Cosmetics

DNA is unique to every individual (except monozygous (identical) twins. DNA comparisons allow for definitive identification of an individual. The biology of DNA and the procedures for analysis are considered in detail in the lecture notes on Genetics & Parentage Testing

This is forensically useful in the **living** (strong evidence of involvement in assault, rape, disputed paternity) and the **dead** (DNA survives in bone for many years, comparison of DNA with family members)

USE OF TEETH TO ESTABLISH IDENTITY OF THE DEAD

(**Reference**: "Forensic dentistry in the identification of victims and assailants". D.K. Whittaker. *Journal of Clinical Forensic Medicine* (1995) **2**, 145-151)

IDENTITY OF DECOMPOSED OR SKELETAL REMAINS

Are the remains human or animal? (butchers offal, skeletal remains of dead pets etc. may be found in unlikely places)

If the remains are only bones:

1. Are they really bones? (wood, stones)
2. Are they human?
3. How many bodies?
4. How long dead? - recent or ancient (e.g. construction or digging at an old burial site)

5. Cause of death?
6. Sex?
7. Age?
8. Race?
9. Stature?

Try out an exercise in identification of skeletal remains for yourself.

Sex
Straightforward in intact bodies except in transvestites, adrenogenital syndrome and hermaphrodites. In mutilated/dismembered or charred bodies the internal sex organs, especially the uterus, cervix and prostate are resilient.

SEX DETERMINATION FROM SKELETON

Based on appearance of pelvis, skull, sternum, long bones. Pelvis is the most important bone for sex determination. Subjective and objective differences are seen between male and female pelves.

Subjective sex differences in the pelvis

	MALE	**FEMALE**
Pelvis as a whole	Thick, heavy, markedly muscular	Smoother, lifgter, more spacious
Brim	Heart shaped	Circular or elliptical
Body of pubis	Triangular shape	Quadrangular
Sub pubic arch	Inverted V shaped	Inverted U shaped
Greater sciatic notch	Deep and narrow	Broad and shallow
Sacro iliac joint	Large	Small
Sacrum	Long and narrow	Short and wide

Objective sex determination from pelvis is based on anatomical pelvic measurements.

SEX DETERMINATION FROM SKULL

Supra orbital ridges
Mastoid process
Palate
Orbit
Mandible

Inexperienced persons can correctly sex over 90% of caucasian skeletons but only 83% of skeletons of American negros.

RACE DETERMINATION FROM BONES

The skull is the only reliable bone. It is not possible to narrow down the identification to racial stock:

- Caucasian (all whites)
- Negro (all blacks - African, American Negroes and West Indians)
- Mongoloid (Chinese, Japanese, American Indians)

Thus skulls of British, Germans, French or Swedes cannot be distinguished from one another. Similarly Japanese skulls are similar to Chinese skulls.

Mongoloid race has characteristically "shovel-shaped" concave upper incisor teeth.

Cheekbones (Zygomatic arches): determine facial width. More prominent in Mongoloids. Width between eyes greater in mongoloids.

Nasal openings: Wider and flatter in Negroids. Narrow in Caucasians.

Femur: Tends to be straighter in Negroids.

DETERMINATION OF STATURE FROM BONES

Long bone length (femur, tibia, humerus) is proportional to height. Tables are used. Fairly reliable up to the age of epiphyseal fusion. There are sex, race, nutrition and personal variations to consider.

AGE DETERMINATION FROM SKELETON

Sex has to be taken into account as bone development and epiphyseal fusion is different between the sexes.

Epiphyseal fusion
The pattern of fusion of bone ends (epiphysis) to bone shaft (metaphysis) in each bone indicates age. Charts & tables are used. Cranial suture fusion is less reliable. Pubic symphysis changes slightly with age. Arthritic changes, osteophytes and osteoporosis give further clues.

Ossification centres
Useful only in foetuses and babies. May be determined radiologically or by cutting into ossification centres. May be confirmed histologically. Most important centre in medico-legal work is the distal centre of the femur. This is present at birth and indicates a full term baby.

THE DATING OF HUMAN SKELETAL REMAINS

Are they ancient or modern bones? (i.e. greater or less than 50 years).

Rate of skeletonisation is highly variable. In the tropics a body can be reduced to a skeleton in 3 weeks. Remarkable preservation of body is seen in acidic peaty soil (e.g. "Pete Bogg" from

Cheshire was 200 years old!). Thus, environmental conditions have to be taken into account.

Naked eye appearance is unreliable:

Tags of soft tissue, periosteum, ligaments etc, indicate less than 5 years old.
Soapy texture of surface indicates age less than a few decades.
Light, crumbling bones are likely to be a century or more old.

Laboratory tests -

1. Immunological reaction between bone extract and anti human serum ceases within months of death.
2. If blood pigments are present bones are usually less than 10 years old.
3. Up to 20 amino acids may be identified in bones less than a century old.
4. Fluorescence of freshly sawn bone surface under UV light diminishes after 100 years.
5. New bones contain 4.0 - 4.5 gms% nitrogen; 2.5 gms% indicates approximately 350 years.
6. Radioactive carbon dating indicates which century.

Individualising skeletal features

Bone disease (Paget's disease, tumours)
Previous injury to bone (fracture callus, prosthesis, metallic fragments).
Comparison of trabecular pattern of bone.
Pattern of skull's frontal air sinuses. Outline is unique and comparisons with antemortem X-rays are useful.

Facial reconstruction

Skull can be scanned into a computer and "fleshed" by computer reconstruction to give likely facial appearance in life. Unfortunately eye colour, hair colour and lips are independent of bony structure.