



# INFANT DEATH

WADS Learning Centre

# INFANT DEATH

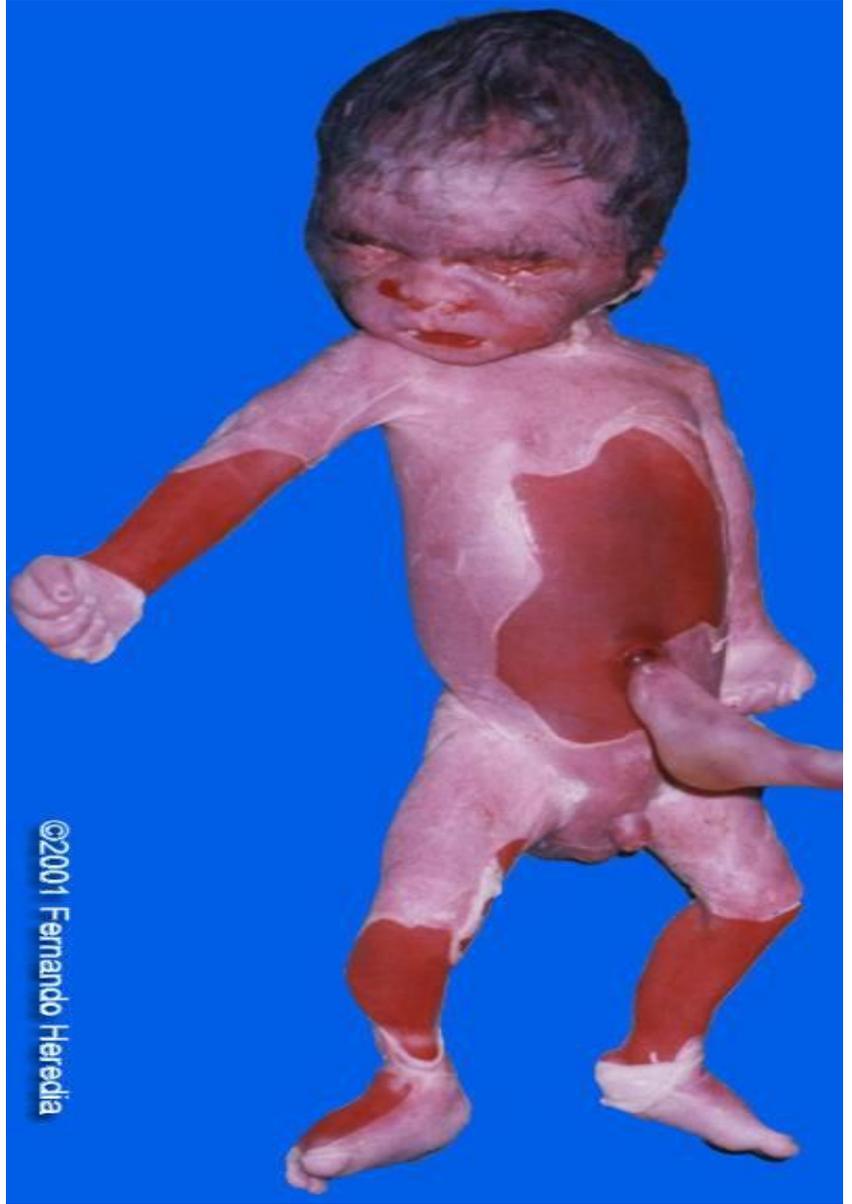
- **Infanticide:** unlawful destruction of a child under the age of one year.
- **Foeticide:** killing of the foetus at any time prior to birth.
- **Filicide:** killing of a child by its parents.
- **Neonaticide** is the deliberate killing of a child within 24 hours of its birth.

# DEAD BIRTH

- A dead born child is one which has died in utero, and shows one of the following signs:
  1. Rigor mortis at delivery
  2. Maceration
  3. Spalding's Sign
  - 4.: Mummification

# Maceration

- Maceration is a process of aseptic autolysis
- The earliest sign of maceration is skin slippage
- soft, flaccid and flattens out
- The skin is red or purple
- Gas in great vessels (aorta in 12 hours) of foetus indicates foetal death.
- Collapse of the vertebral column occurs.
- It has a sweetish, disagreeable odour.
- Abnormal mobility of joints





### 3. Spalding's Sign:

- overriding of the bones of the cranial vault.
- occurs due to shrinkage of the cerebrum after death of the foetus.

### 4.: Mummification:

- occurs when the foetus dies from deficient supply of blood.
- when liquor amni is scanty, and when no air enters uterus.

# SPALDING'S SIGN

- Is a sign of dead birth
- Loss of alignment & over riding of cranial bones, due to shrinkage of brain.
- Seen on x-ray.

# STILLBIRTH

- **A stillborn child:** The child was alive in utero, but dies during the process of birth.
- A stillborn child is one which was born after 28 weeks of gestation and which did not breathe or show any signs of life, at any time after being completely born.

## Indications of stillbirth:

- Signs of prolonged labour,
- oedema and bleeding into the scalp,
- a caput succedaneum ( cone-head appearance), and
- severe moulding of the head.



**Fig. (19-1).** Caput succedaneum.



**Fig. (19-2).** Cephalhaematoma over the right parietal bone.

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- **Caput succedaneum** : An area of soft swelling that forms in the scalp, over the presenting part of the head, in vertex presentation.
  - **Cephalhematoma**: Accumulation of blood between periosteum and skull due rupture of periosteal capillary (pressure of birth, instrument delivery, vacuum delivery)



Common causes of stillbirth are:

- prematurity,
- anoxia of various types,
- birth trauma especially intracranial haemorrhage due to excessive moulding
- placental abnormalities,
- toxaemias of pregnancy,
- erythroblastosis foetalis, and
- congenital defects.

# Viability of the Infant

- Viability means the physical ability of a foetus to lead a separate existence after birth apart from its mother, by virtue of a certain degree of development.
- A child is viable **after 210 days** of intrauterine life, and in some cases after 180.

# Live birth

- It means that the child showed signs of life when only part of the child was out of mother, though the child may not have breathed or completely born.
- The causing of death of such a child is regarded as homicide.
- The law presumes that every newborn child found dead was born dead until the contrary is proved.
- In criminal cases, signs of live birth have to be demonstrated by post-mortem examination of the child.

# SIGNS OF LIVEBIRTH

## Shape of the Chest:

- Before respiration, the chest is flat and its circumference is one to two cm less than the abdomen at the level of the umbilicus.
- After respiration, the chest expands and becomes arched or drum-shaped.

(The Position of the Diaphragm : the highest point of the diaphragm is noted. which is found about the level of fourth or fifth rib if respiration has not taken place. and at the level of the sixth or seventh rib after breathing.

### (III) Lungs :

- (1) Volume: Lungs fill up the pleural cavities
- (2) Margins: become rounded. Surface appears mottled or marbled
- (3) Consistency: Spongy, crepitates
- (4) Colour is light red and Expansion of the Air Vesicles
- (5) Cut section: Exudation of frothy blood.

# Differences between respired and un respired lung

Features	Respired lung	Un respired lung
Chest	Arched or drum shaped	Flat
Diaphragm	Sixth or seventh rib	Fourth or fifth rib
<b>Lungs</b>		
Position	Fill the thoracic cavity, overlap heart, taut pleura	Lying in the back of thoracic cavity, covering on pleura loose
Volume	Voluminous	Small
Colour	Mottled pink	Uniformly reddish brown
Appearance	Marbled due to expanded air vesicles	Smooth and not marbled
Consistency	Spongy, elastic & crepitant	Dense, firm, liver-like and non crepitant
Cut section	Exude frothy blood	Exude little blood

# The Hydrostatic Test

## Principle:

- Respired lung should float because the specific gravity is around 940.
- (Unrespired lung: 1040 to 1050 ).

## Method

- Tie main bronchus by ligature, separate the lungs & place each in water .
- If it floats, cut each lung into 12 to 20 pieces & place them again in water.

# The Hydrostatic Test

- If they float, squeeze each piece & place in water.

## Inference:

- Floatation of all squeezed bits - Fully respired
- Floatation of some pieces - Partially respired
- Sinking of all pieces - Un respired

# The Hydrostatic Test

Fallacies :

**Unrespired lung may float ( False positive test )**

- Accumulation of decomposition gases-putrefaction
- Artificial respiration

**Respired lung may sink- ( False negative test )**

- Very feeble respiration
- Oedema of lungs
- Atelectasis, Congenital pneumonitis

# The Hydrostatic Test

## Hydrostatic test is **NOT NECESSARY:**

- Gross congenital anomaly ( Anencephaly )
- Gestation period is less than 180 days.
- Macerated or mummified
- Umbilical cord separated & scar formed- LIVE BIRTH.
- Stomach contains milk

## Lung microscopy in respired lung:

- Expansion of alveoli
- Flattening of lining cells
- Patency of blood vessels

#### (iv) Static Test or Fodere's Test:

- The average weight of both lungs before respiration varies from 30 to 40 g., and after respiration from 60 to 66 g. The increase in weight is due to the increased flow of blood.

#### (V) Ploucquet's Test:

- The blood flow in the lung beds is so increased after breathing that their weight is almost doubled from  $\frac{1}{70}$  of the body weight before respiration to  $\frac{1}{35}$  after respiration.

## Changes in the Stomach and Intestines

- Air is swallowed into the stomach during respiration. The stomach and intestines are removed after tying double ligatures at each end.
- They float in water if respiration has taken place, otherwise they sink.
- This is known as

Breslau's second life test

or

Stomach-bowel test.

- **(v) Changes in the Middle Ear: (Wredin's Test).** Before birth, the middle ear contains gelatinous embryonic connective tissue.
- With respiration, air replaces the gelatinous substances in few hours to five weeks.
- **(vi) Blood:** Nucleated red cells usually disappear from the blood within 24 hours.

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- **Foetal hemoglobin** which is about 80% before birth rapidly decreases to 7 to 8 percent at third month.
  - **(vii) Skin** : At first skin is bright red, which becomes darker on second or third day, then brick-red, yellow and normal in about a week.
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### (viii) Air in GI Tract:

- The air reaches stomach after fifteen minutes,
- the small intestine after one or 2 hours,
- the colon after 5 to 6 hours,
- rectum after 12 hours.

### (ix) Circulation:

- The umbilical vein and ductus venosus are closed on the fourth day.
- The ductus arteriosus closes by tenth day,
- foramen ovale by second or third month.

# Other signs of live birth

- ▶ Meconium
  - ▶ Caput Succedaneum
  - ▶ Skin: Vernix caseosa
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# Causes of Death

## Natural Causes :

1. Immaturity.
2. Debility due to lack of general development.
3. Congenital diseases, Malformations.
4. Hemorrhage from the umbilical cord,
5. Post maturity.
6. Placenta praevia or abnormal pregnancy.
7. Cerebral birth trauma.
8. Erythroblastosis.

## Accidental Causes,

- Prolonged labour
- Prolapse of the cord or pressure on the cord
- Injuries to the mother: Heavy blows or kicks on the mother's abdomen or falls from a height may cause concussion of the brain of the child with or without fracture of skull or rupture of blood vessels

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- **Suffocation:** If the face is pressed accidentally in the cloth or submerged in the discharges, such as blood, liquor amnii or meconium.
  - **Precipitate Labour:**
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# Precipitate Labour

- The process of labour terminating in a much shorter time than usual is called precipitate labour.
- All the **stages of labour get merged into each other.**
- Delivery occurs rapidly **without the knowledge of the mother**
- Descent of child may be mistaken as bulky evacuation by the mother.
- Usually occurs in **multiparous** women.

# Precipitate Labour

Death of the foetus may occur due to:-

- **Head injury**, due to falling on hard floor
- **Suffocation** due to falling into lavatory pan
- **Haemorrhage** from torn end of cord

# Precipitate Labour

## P.M. Appearances:

- Absence of caput succedaneum/cephalhematoma
- Evidence of head injury, suffocation etc, may be present
- Umbilical may show evidence or of tearing

# Precipitate Labour

## M.L.I.

- Infanticide may **falsely be suspected** in an actual case of precipitate labour
- A case of infanticide may be **passed** off as precipitate labour.

# Criminal Causes of infant death

- (1) acts of commission, (2) acts of omission.

## Acts of Commission:

- 1) Suffocation,
- 2) Strangulation,
- 3) Drowning,
- 4) Burning, Blunt head injury,
- 5) Fractures and dislocation of cervical vertebrae,
- 6) Wounds: killed by stabbing, incised wounds, cut-throat, Concealed punctured wound
- 7) Poisoning.
- 8) By burying alive

# Acts of Omission or Neglect:

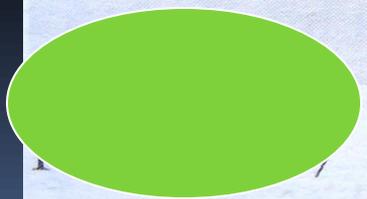
1. Failure to provide proper assistance during labour may cause death by suffocation or head injury.
2. Failure to tie the cord after it is cut may cause death by hemorrhage.
3. Failure to clear the air-passages.
4. Failure to protect the child from exposure to heat or cold.
5. Failure to supply the child with proper food.

## THE ABANDONING OF INFANTS:

leave a child in any place with the intention of abandoning the child, shall be punished with imprisonment up to seven years (Sec. 317, I.P.C.).

## CONCEALMENT OF BIRTH :

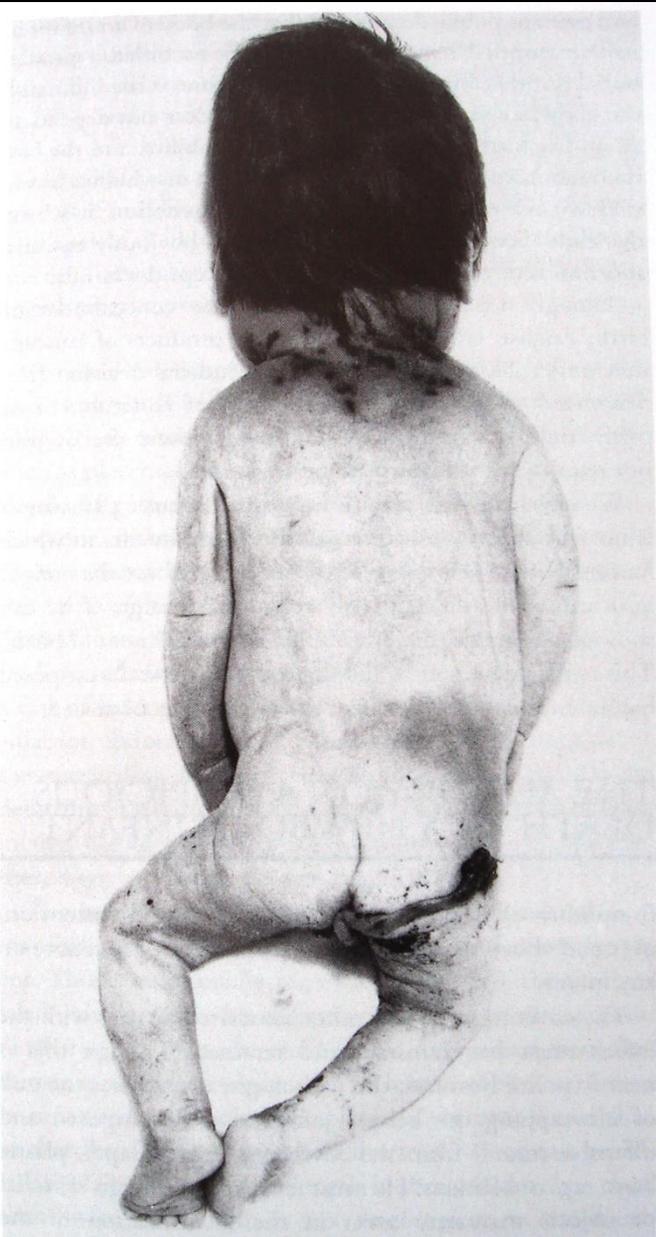
Whoever, secretly buries or otherwise disposes of the dead body of child, whether such child dies before or after or during its birth, intentionally conceals the birth of such child, shall be punished with imprisonment up to two years (Sec. 318, L.P.C).



*Definite infanticide, the child having fully respired before having this severe incised wound of the neck made with a kitchen knife.*

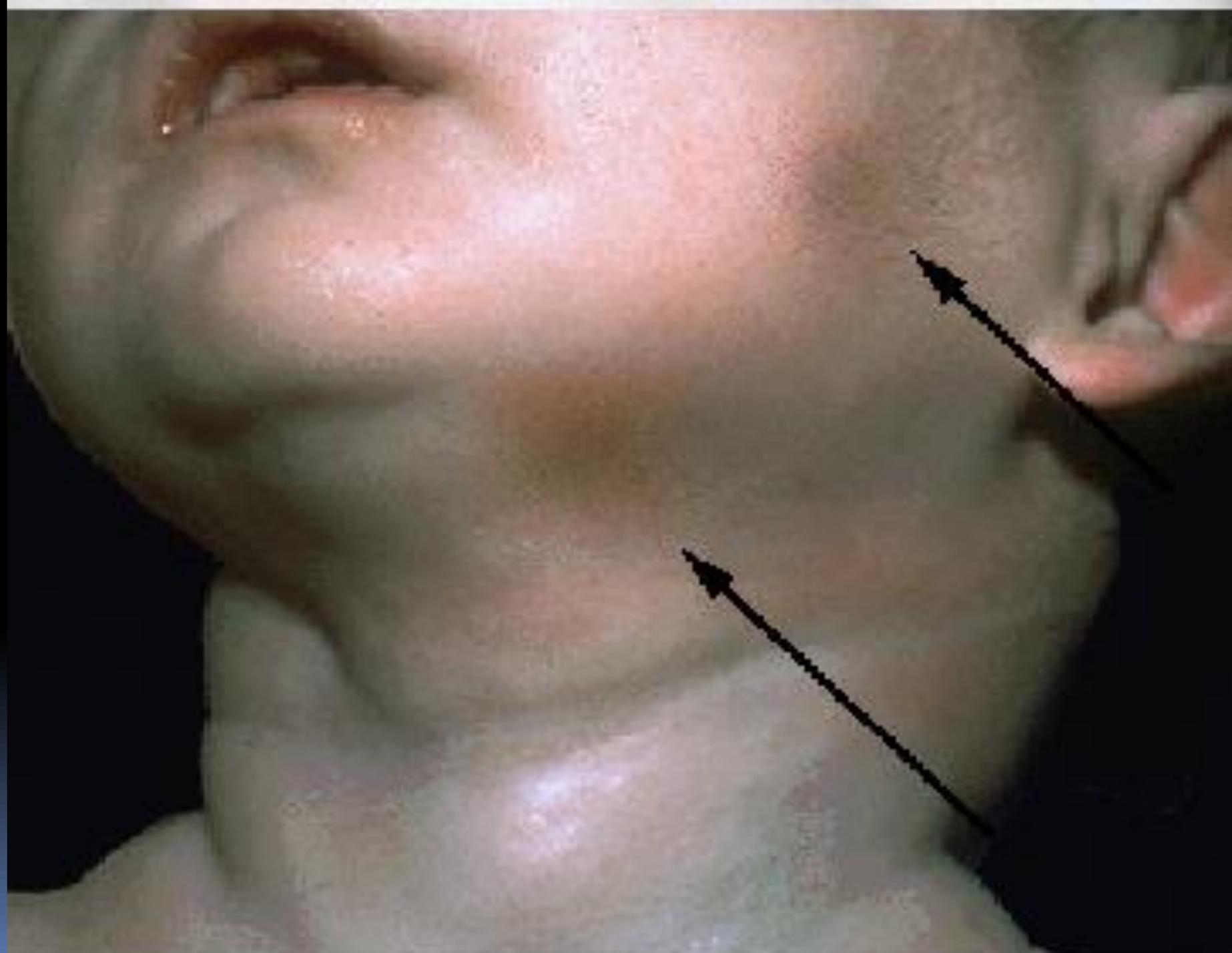


*Full-term newborn found wrapped in a blanket inside a shopping bag in a refuse container. The cord had been cut with a sharp instrument, but the child was not washed or fed. The lungs showed no positive evidence of respiration.*



Circumferential injuries around the neck caused by fingernails due to attempts at self delivery. Such injuries should not be mistaken for infanticide.





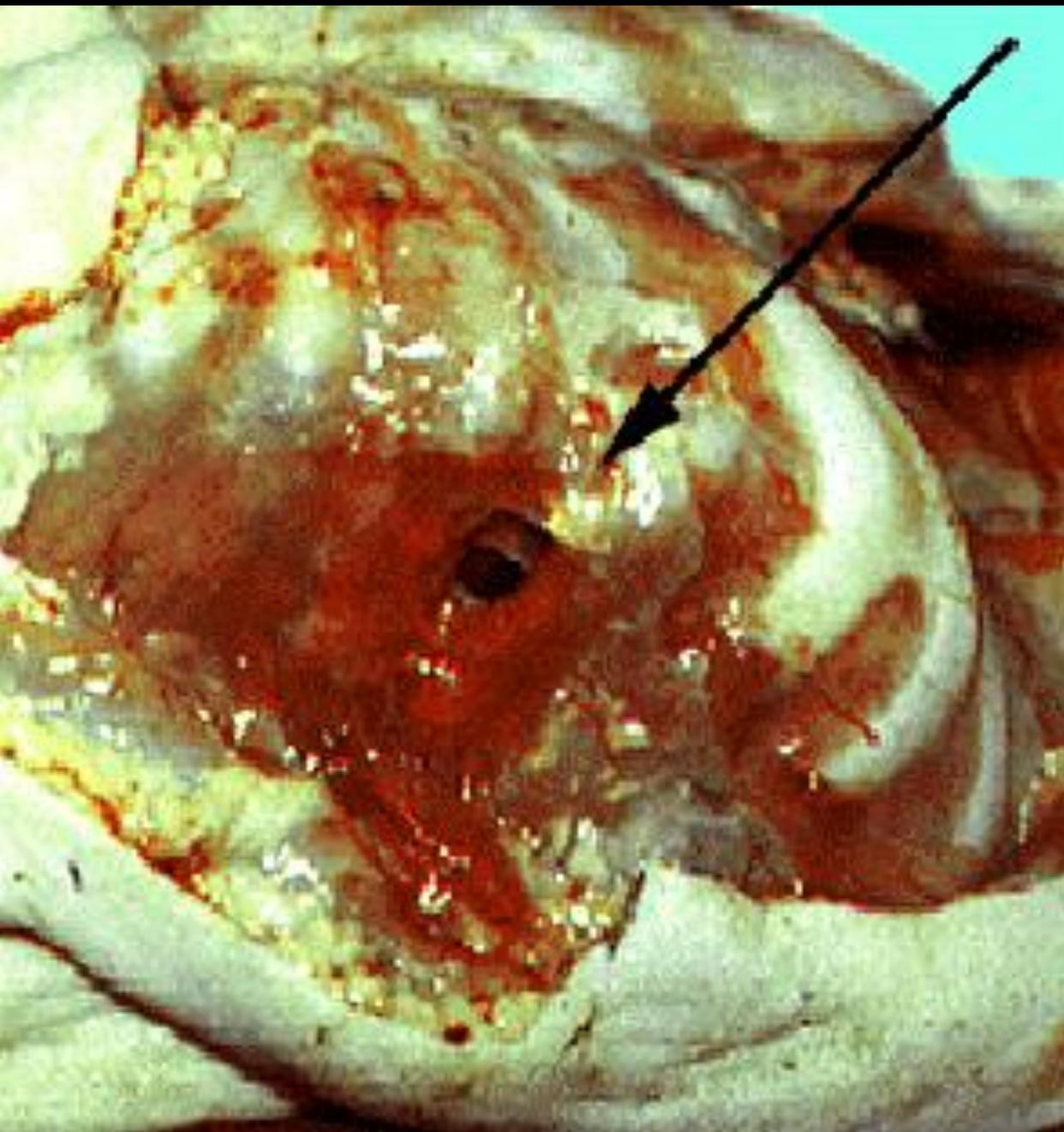
# Contusion











# The Aims and Objectives of Foetal autopsy

1. Whether the child was stillborn or dead born.
2. Whether the infant has attained viability or not.
3. Whether the child was born alive.
4. If born alive, how long did the child live.
5. What was the cause of death.

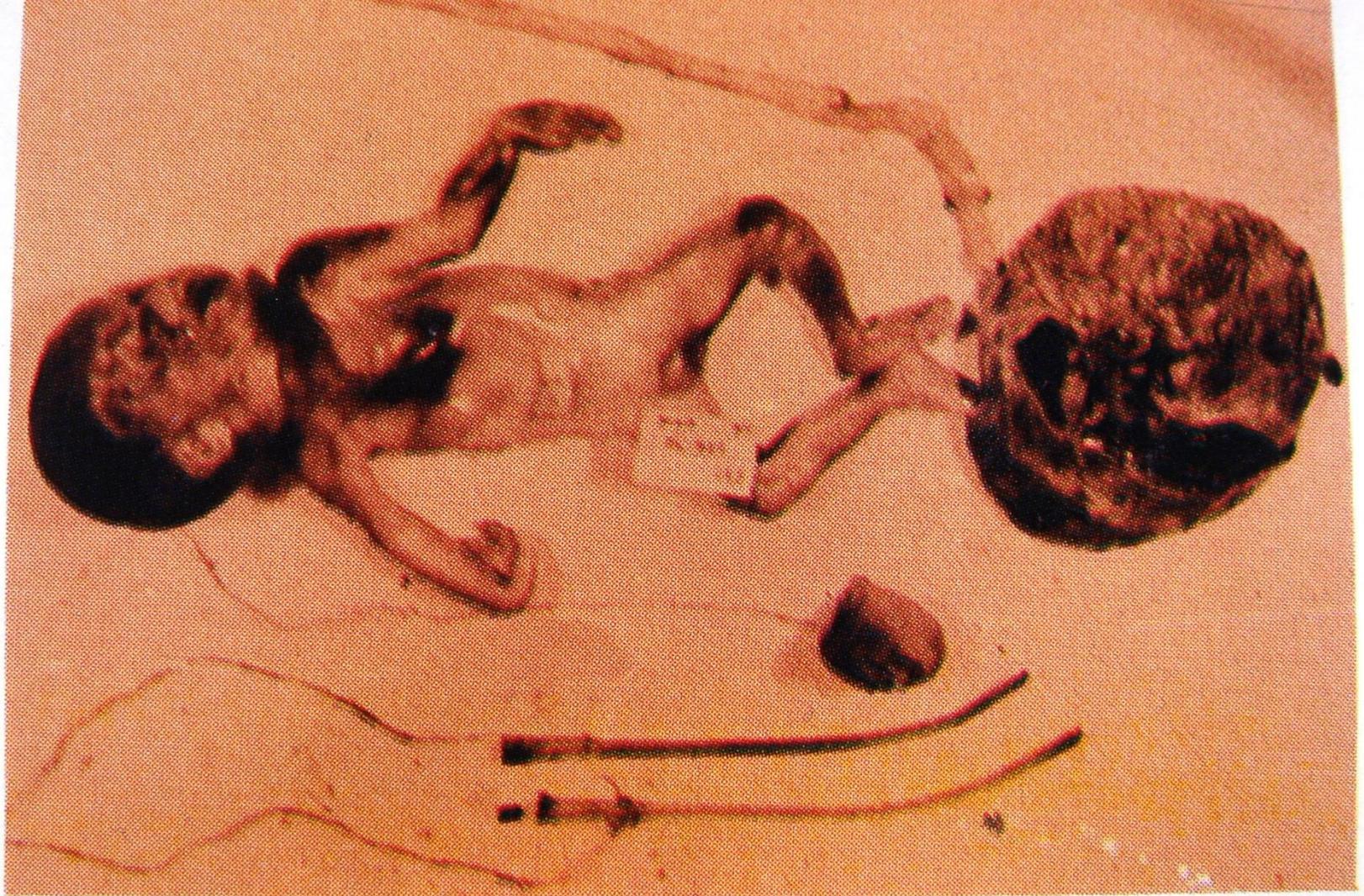
# HAASE'S RULE

- CROWN-HEEL length.
- Up to 25 cm: Square root
- Beyond 25 cm: Divide by 5 (MORRISON'S Rule)
- Age is in lunar months.

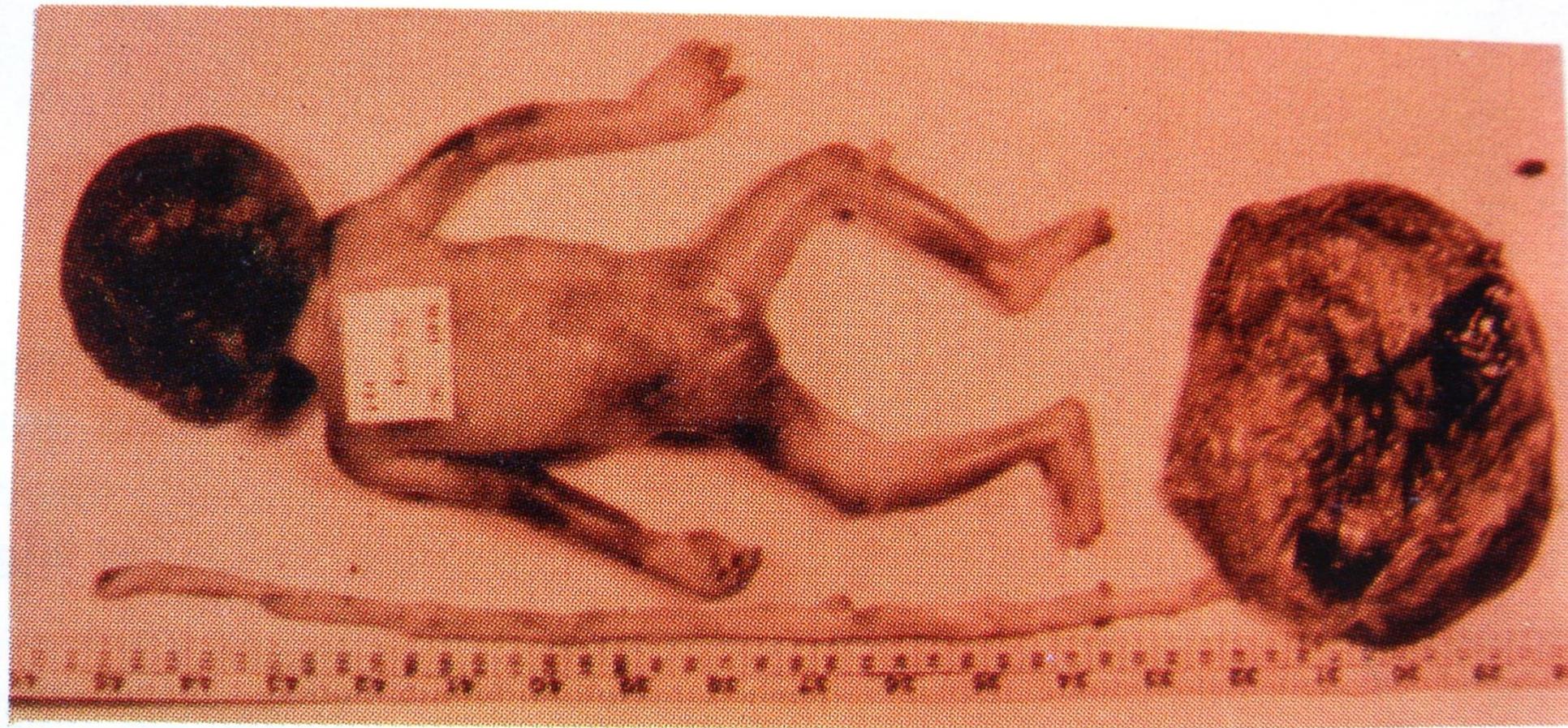
4 cm



FIGURE 20.12 *Fetal maturity: up to the twentieth week the length of the fetus in centimetres is approximately the square of the age in months (Haase's rule).*



**Fig. 11.2:** Criminal abortion: Evacuated foetus (3-4 months), umbilical cord and placenta with amniotic sac membrane. Metal catheters (two) used to procure abortion are also seen

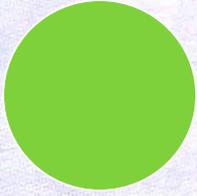


**Fig. 11.1:** Criminal abortion at  month.  
Length of the foetus is 16 cm



FIGURE 20.13 *Fetal maturity: by Haase's rule this 18 cm crown–heel fetus is about  months old.*

30 cm



## Changes in the UMBILICAL CORD.

- Shrivels, dries : 12 – 24 hours
- Falls off : 5 – 6 days
- Healing of ulcer: 10 – 12 days.

## Changes in the umbilical cord

- ▶ 50cms long

2hrs ---- Blood clots at cut end

12-24hrs --- cord shrinks & dries

36-48hrs --- inflammatory ring

2-3day --- mummifies

5-6day --- falls off & leaves an ulcer

10-12days --- forms a scar



## Estimation of maturity:

- 1 Month – 1.25 cm, limb buds seen.
- 3 Months - 9 cm, nails, ossification in ischium.
- 5 Months - 25 cm, 225 – 450 gms, ossification centre for CALCANEUM appears.

Fine scalp hairs, lanugo, Vernix appears

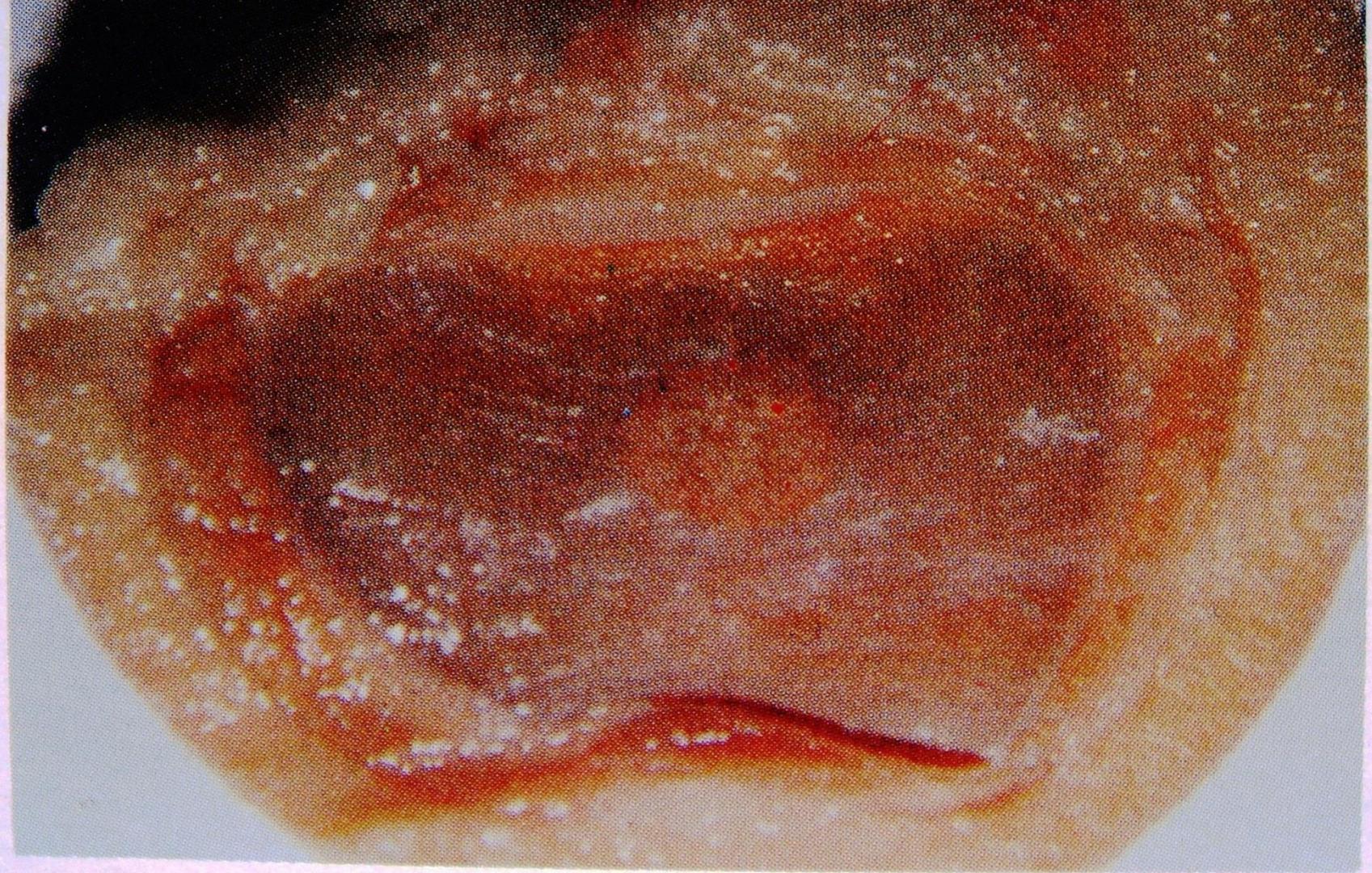
Meconium in large intestine

Nail appears

- 6th month- 30 cms. 450-900gms.  
Distinct scalp Hair, vernix caseosa.  
Eyebrows, eyelashes appears  
Nail distinct, Sternum- 2 centers appear.
- 7 Months - 35 cm, 900 – 1800 gms  
Centres for TALUS and Sternum (3 centres).  
Nails upto fingertip but do not extend beyond nail  
bed .Subcutaneous fat appears. Testes at Int.Ing.  
ring

- 
- 8 Months - 40 cms.
  - Centers for lower end of Sternum (5 centres).
  - Nails upto fingertip.
  - 9 Months - 45 cm. Centres for CUBOID, lower end of femur appear. Nails extend beyond nailbed. Testicles at external inguinal ring.
- All Sternal centres appeared.
- Full Term - 50 cms, hair 2-3 cm, , Testes descended.





. Ossification centre in lower end of femur (appearance at the end of the ninth month i.e. full term: 0.5 cm in diameter i.e. 0.5-0.8 cm)



1. Ossification centres at full term in bones foot. Their appearance: (1) in calcaneum: at the end of fifth month, (2) in talus: at the end of seventh month, (3) in cuboid: at the end of ninth month (i.e. full term)

# CHILD ABUSE

# BATTERED BABY SYNDROME

- A battered baby or child is one who has received repetitive injuries as a result of non accidental violence, inflicted by the parent or guardian.

# BATTERED BABY SYNDROME

## Features:-

- Victim is usually a child less than 3 to 5 years old. May be an unwanted child because of illegitimacy, poverty etc.
- Parents usually young & illiterate belonging to low socio-economical status. There is often history of marital discord, alcohol abuse, poverty, psychiatric problems etc.

# BATTERED BABY SYNDROME

- Violence is usually precipitated by the child inadvertently crying, refusal to be quiet, persistent bed wetting etc.
- Discrepancy between the nature of injuries & explanation offered.
- Inordinate delay between the time of injury & the time the child is taken to a doctor.

# BATTERED BABY SYNDROME

- Presence of old injuries of different intervals.
- Repetition of injuries usually becoming more severe with the passage of time.

# BATTERED BABY SYNDROME (Caffey's Syndrome )

## **Common injuries:**

- Bruises, abrasions or lacerations (of different ages) usually on the face or neck.
- There may be buccal mucosal tears due to blows on the face.
- Bite marks, 'Six penny' contusions



**Fig. 15.2** Classical injury to the mucosa of the upper lip as a result of an upward blow to the face.



Shows an area of bruising of varying age (similar to that shown in Fig. 15.4) over the front of the upper chest

# BATTERED BABY SYNDROME (Caffey's Syndrome )

- Retinal separation and haemorrhage.
- Visceral injuries - usually involving liver or spleen, mainly resulting from blunt force.
- Injuries resulting from beating or kicking or shaking the child violently (eg. Whiplash injury, chronic sub dural hematoma etc ).

‘ Shaken Baby Syndrome ’

# BATTERED BABY SYNDROME (Caffey's Syndrome )

- Burns: Small circular, pitted burns with cigarette,
- Skeletal Injuries: Large periosteal haematomas are common

# BATTERED BABY SYNDROME (Caffey's Syndrome)

- Bald patches on the scalp due to pulling out the hair (traumatic alopecia).
- Fractures of bones, epiphyseal shearing etc.
- Burns ( eg. with lighted cigarette ) & scalds.
- Delay in seeking medical assistance.

## Role of the doctor:

- Identify & Inform the police.
- Persuasion is of no use.





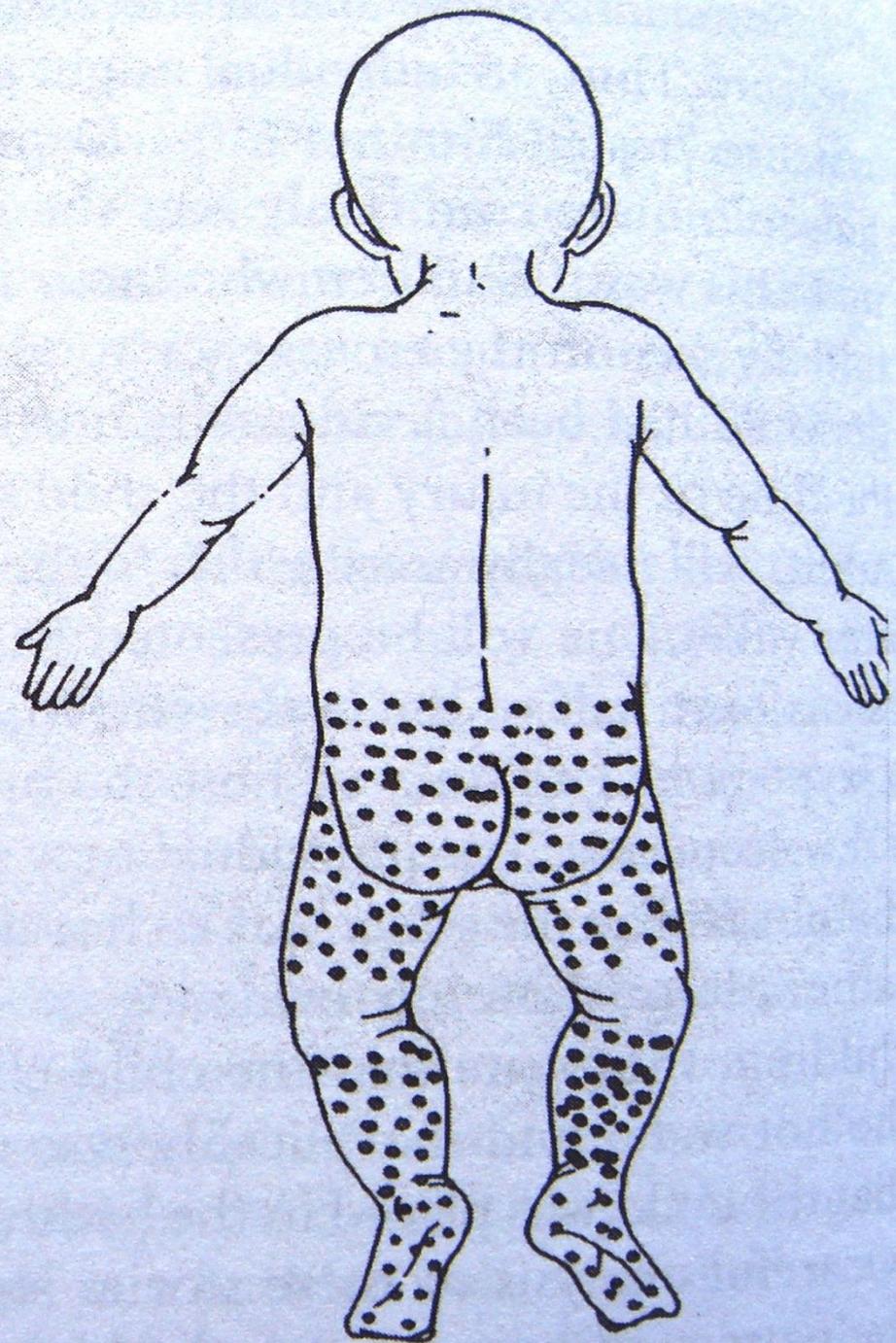
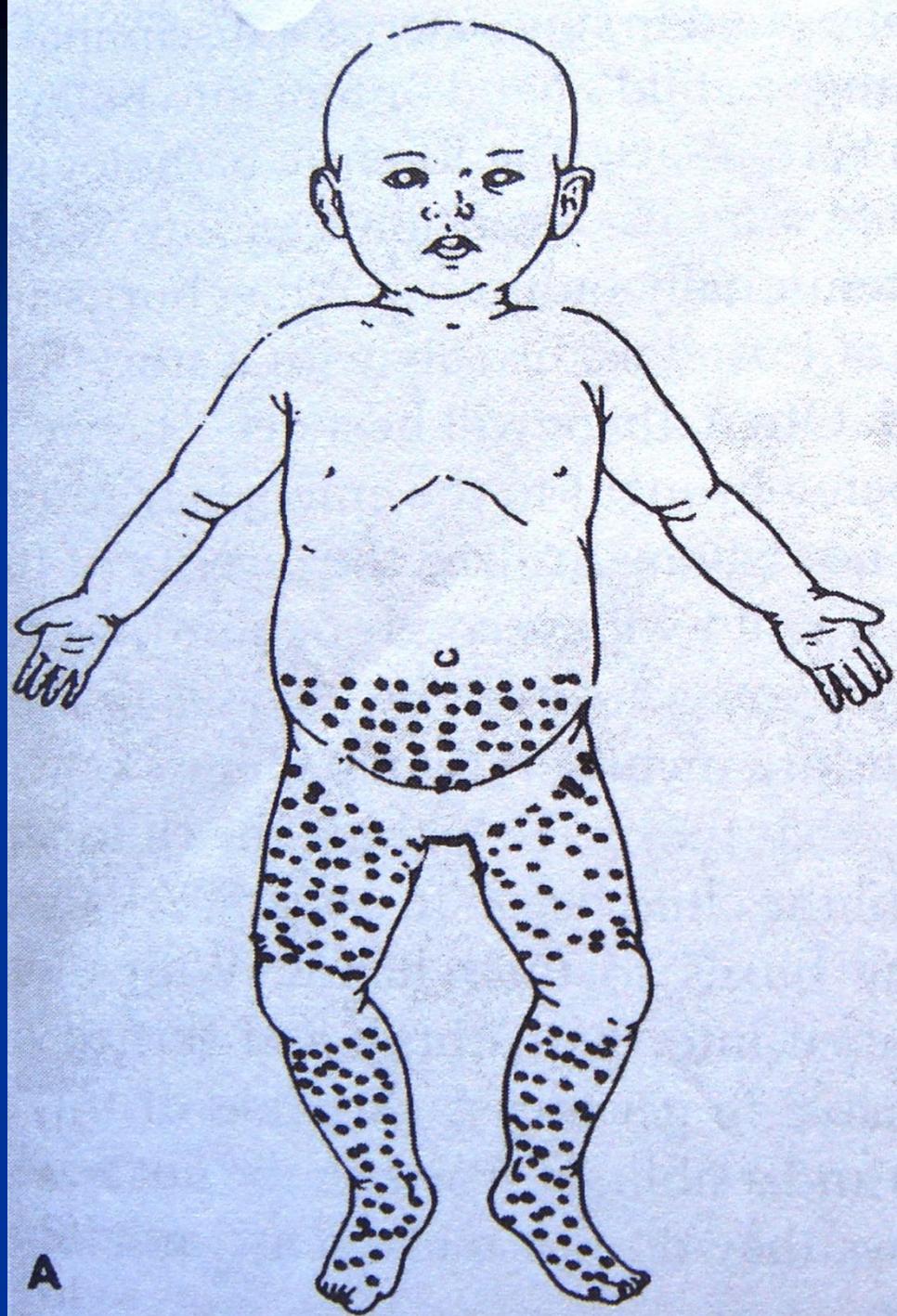
**Fig. 15.4** The back of a child showing the classical areas of bruising of varying age over the body together with a moderate nappy rash.



**Fig. 15.6** Extensive deep bruising over the scalp on reflection.



Example of bilateral 'black eyes'.



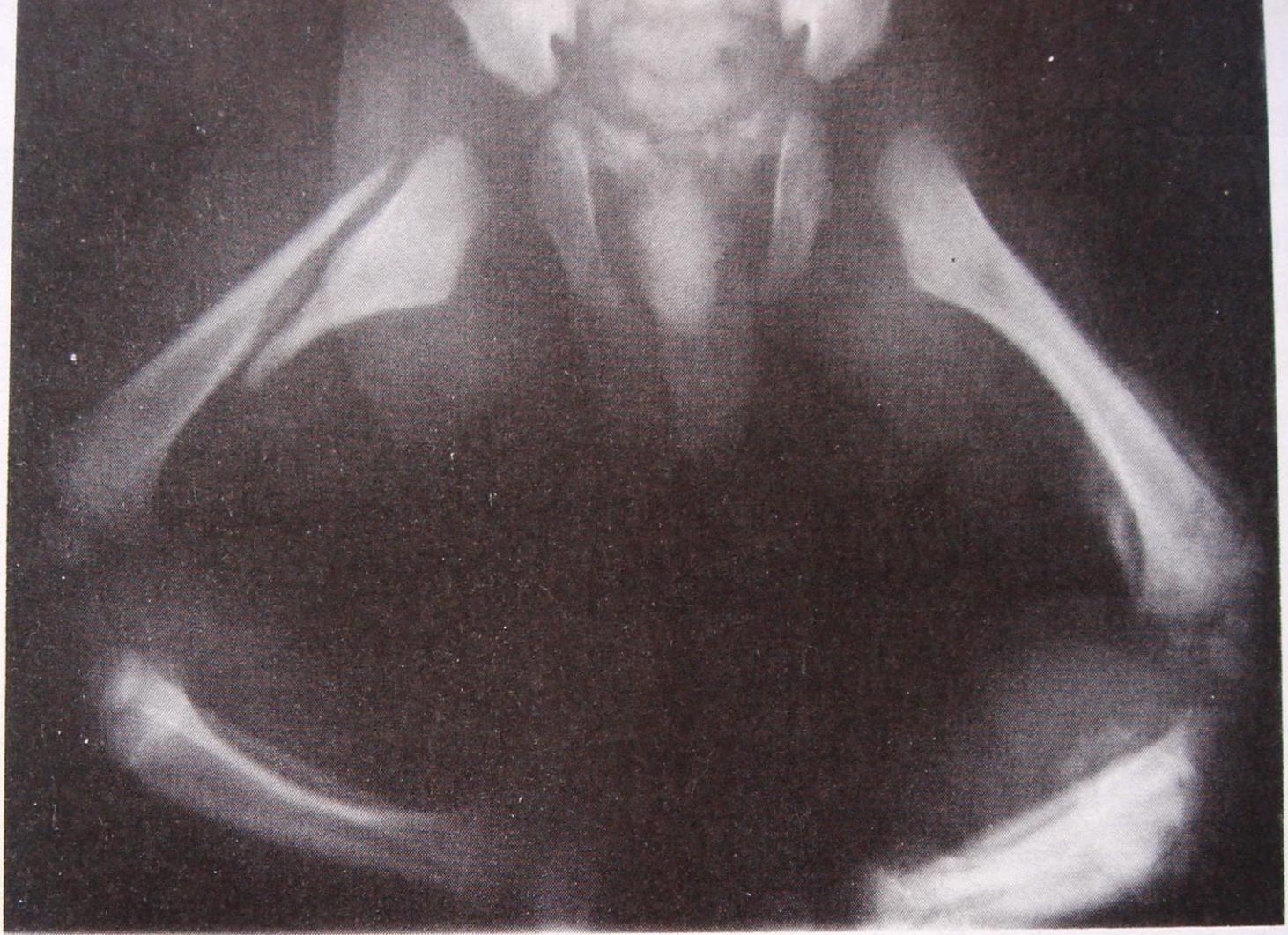
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**Fig. 15.11** Classical scald burns as a result of immersion in boiling water. Note the absence of burning on reflection of the legs but nevertheless the extensive bruising associated with the outer aspect of the left knee.



**Fig. 15.12** Extensive napkin erythema with pock-like scars from old healed ulceration extending over the genitalia, perineum and the soles of the feet.



**Fig. 15.13** Oblique fractures of the shaft of the right femur with no visible callus, indicating that the injury is less than a week old. This is the torsion-type fracture which could be caused by an accidental fall. The presence of metaphyseal injuries with callus formation in the distal end of the left femur and in the proximal end of the tibia indicate that the fractures of the right femur could be the result of a non-accidental injury. Judging by the amount of callus present, these metaphyseal injuries are about 2-3 weeks old.



**Fig. 15.15** Loose piece of bone at posterior aspect of distal end of tibia.



Raccoon eye



Multiple injuries



Intra oral injuries



Pattern of a shoe print



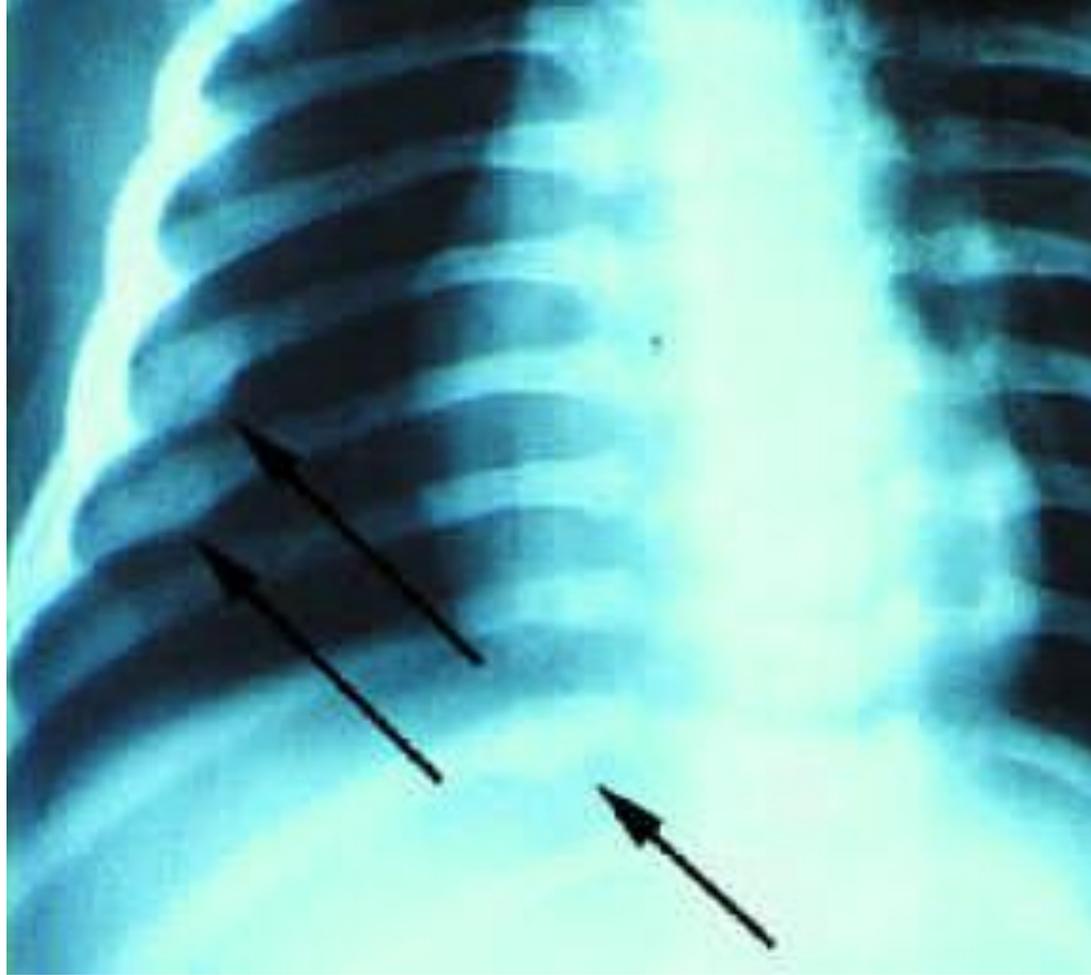
Cigarette burns



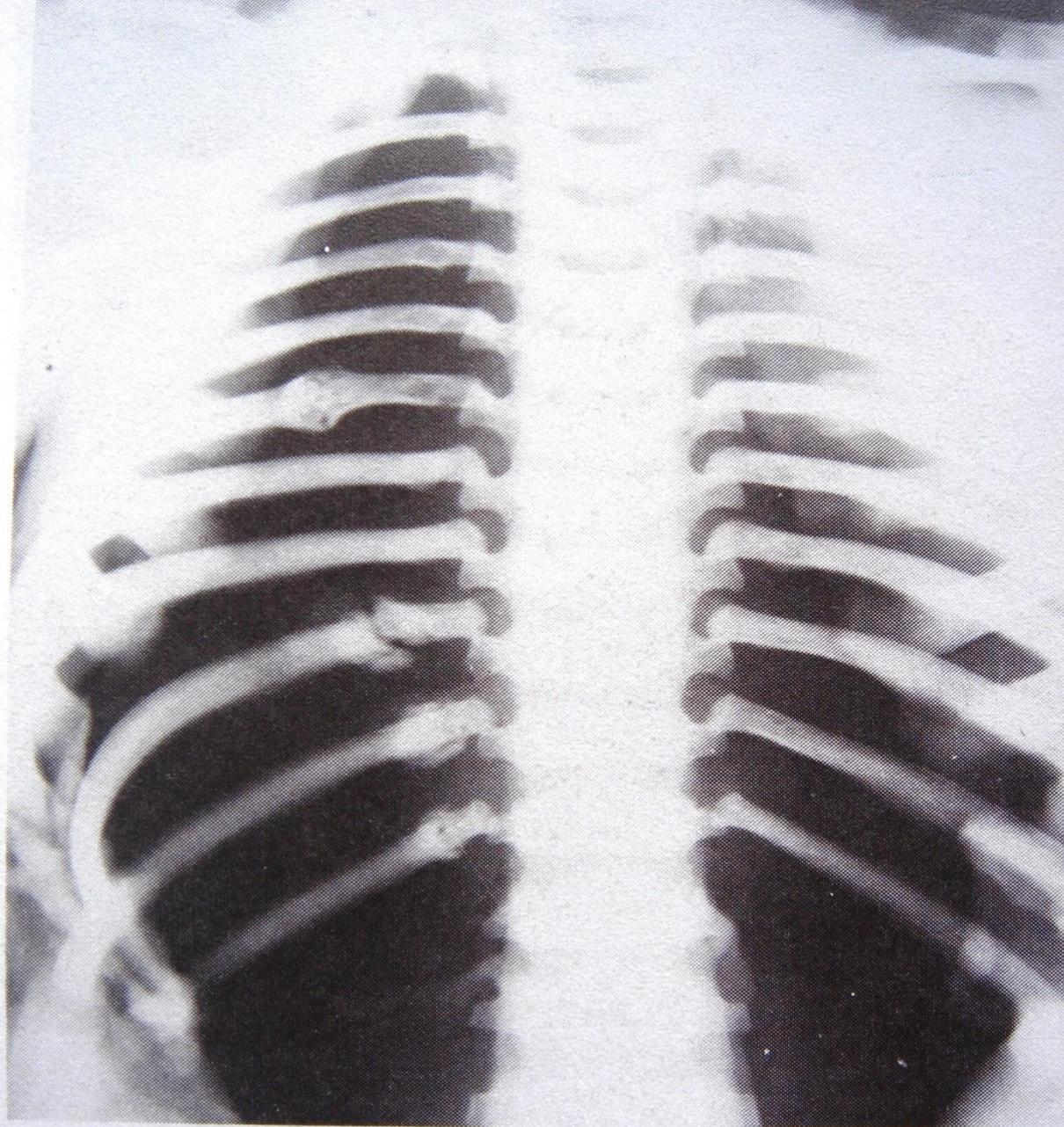
Burn on this girl's buttock was caused by placing her on a stove as punishment for a minor offense



Contusion of different ages



“Puff ball” type lesions of healing rib fractures.  
Posterior rib fractures are almost always the result  
of abuse.



**Fig. 15.16** As healing progresses, the nodules become contracted and less dense.



Laceration of the liver



**Fig. 15.28** Caffey's disease—periosteal new bone formation along the shafts of the radius and ulna; this does not extend to the metaphyses, which are normal.



**Fig. 15.29** Caffey's disease—the tibia and fibula of the same case as in Fig. 15.28.



**Figure 12.1** (A) Loop-shaped contusions caused by coat hanger. (B) Imprint of belt.



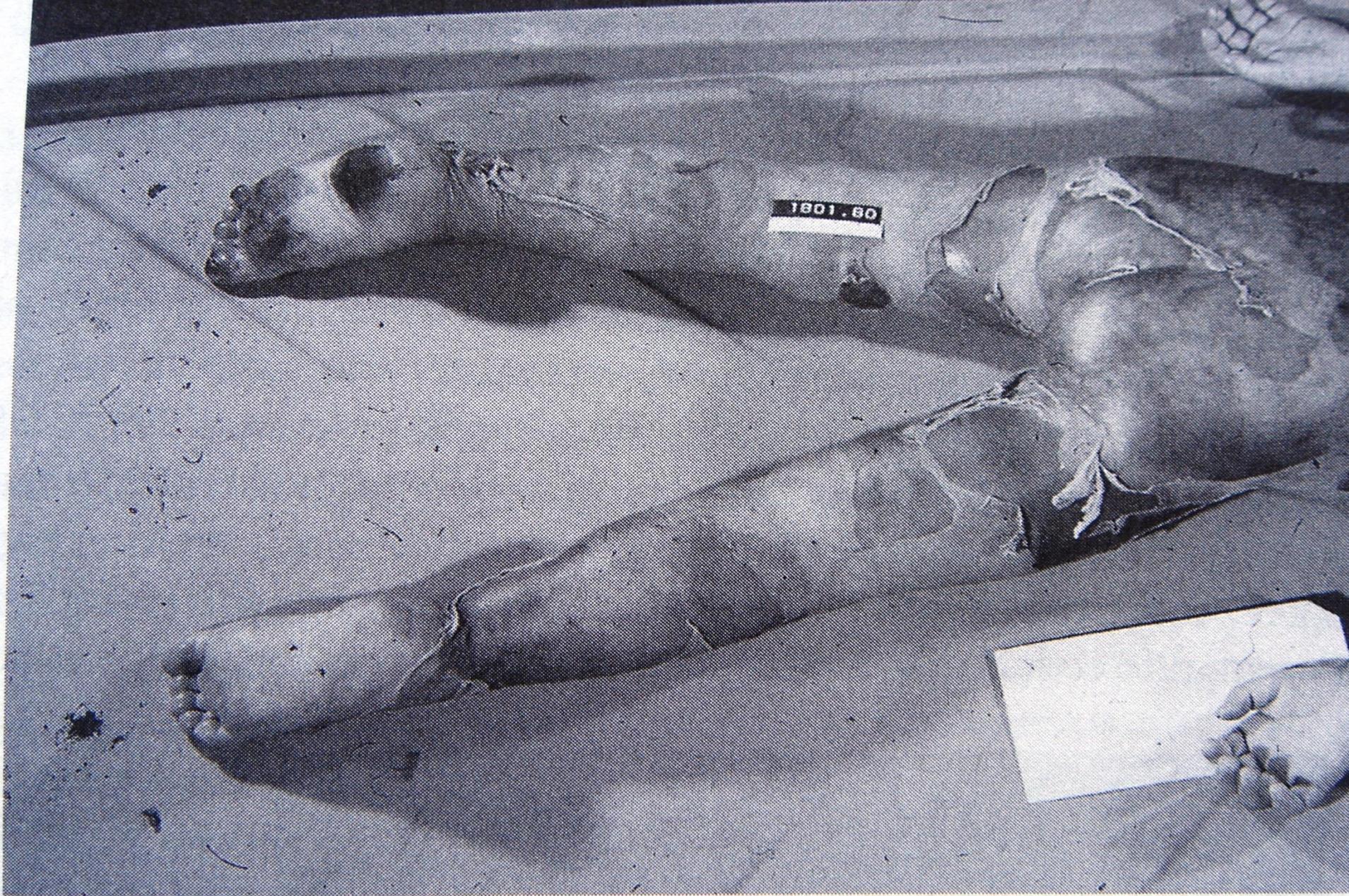
**Figure 12.3** Laceration of mucosa of lip caused by blow to mouth.



**Figure 12.5** A 32-month-old child brought to Medical Examiner's Office with diagnosis of SIDS. Externally, (A) three healing scabs of forehead and excoriation of chin. At autopsy, (B) fracture of neck at C6-7. Parent admitted slamming child's head against bed, face down



**Figure 12.6** (A) Illustration of usual distribution of scalding burns with sparing of knees, popliteal fossae, and inguinal regions. (B) Sparing of knees (*continued*).



**Figure 12.6** (continued) (C) Sparing of popliteal fossa.



**Figure 12.7** A 2-month-old child brought to Medical Examiner's office as a SIDS death. At autopsy, no injury and no petechiae. Mother subsequently admitted smothering child with towel.

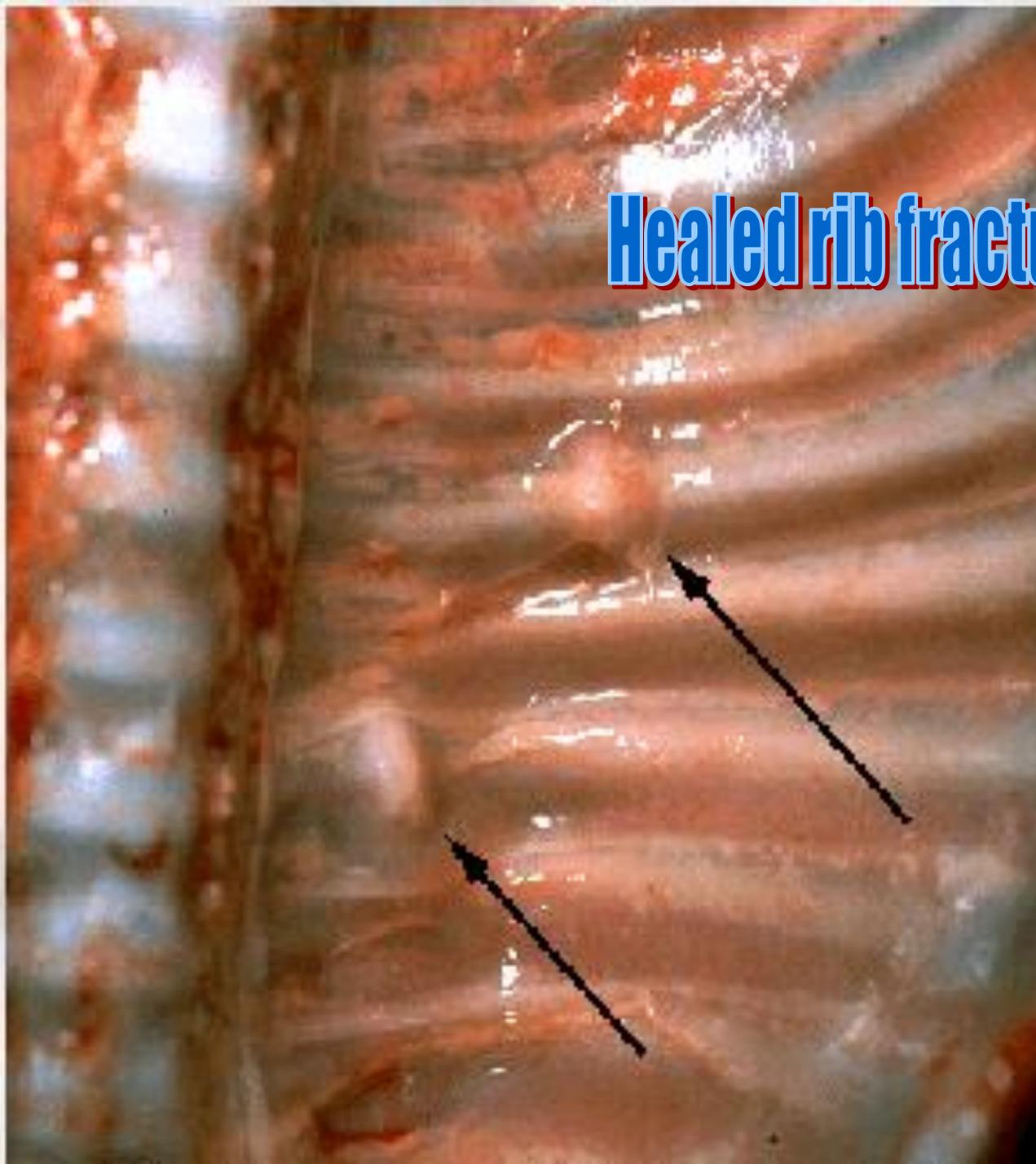








# Healed rib fractures





# Child Sexual Abuse

- Examination done by Forensic medicine specialist along with a gynaecologist and a paediatric surgeon.
- All relevant orifices of the body are thoroughly examined.
- Vaginal examination may be conducted under general anaesthesia.
- Psychological trauma of child should be born in mind.

# Differential Diagnosis

- Rickets
- Scurvy
- Haemophilia
- Bone formation disorder
- Alopecia areata
- Accidental burns
- Self inflicted injuries
- Pigment anomalies

# MUNCHAUSEN'S SYNDROME BY PROXY

- It is a peculiar and dangerous type of child abuse usually involving the mother,
- children are brought to doctors for induced signs and symptoms of illnesses with a fictitious history.
- The sex ratio is almost equal,
- child is admitted frequently in the hospital for medical evaluation for the non-existent conditions.

## diagnostic criteria:

- (1) Illness produced or alleged, or both, by a parent.
- (2) Repeated requests for medical care of a child, leading to multiple medical procedures.
- (3) Parental denial of knowledge of the cause of symptoms.
- (4) Regression of symptoms when the child is separated from the parents.

## Method of simulation or production of illnesses:

- (1) The mother pricks her finger and adds blood to the urine of the child and takes the sample to the doctor.
- (2) The child's nose is closed with two fingers and the lower jaw pushed up with the palm to block the airway.
- (3) A pillow or towel is put over the face of the child and the face is pushed down into bed clothing.
- (4) The mother gives insulin to the child and takes to hospital with hypoglycemia.
- (5) Vomiting allegation,

- 
- (6) Diarrhea: laxatives, salt poisoning.
  - (7) Convulsions: allegation or by theophylline, insulin, psychotropic drugs.
  - (8) Bleeding: anticoagulants, phenolphthalein poisoning, exogenous blood.
  - (9) CNS depression: barbiturates, benzodiazepines,
  - (10) Fever: alleged.
  - (11) Rash: by scratching.

# SUDDEN INFANT DEATH SYNDROME

- **Cot death or crib death** is defined as the sudden and unexpected death of seemingly healthy infant,
- whose death remains unexplained even after thorough case investigation. death scene examination, review of clinical history and complete autopsy.
- Cot deaths are major cause of death in infants in the first six months of life.

## Features :

- (1) **Incidence** : 0.2 to 0.4% of Live births.
- (2) **Age**: One week to one year. Majority of cases occur between six weeks to six months with a marked peak between two to four months.
- (3) **Sex** : Male to female ratio of about 3:2.
- (4) **Twins**: There is increased risk (threefold) amongst members of a twin. Most twins are premature and of low birth weight.
- (5) **Geographical distribution**: The occurrence is worldwide

- (6) **Time of death** : Death always occurs during sleep at all times of night with a moderate increase in the early morning hours.
- (7) **Pre maturity** has a higher risk.
- (8) **Low Socioeconomic standard of the family.**
- (9) **Cigarette smoking and drug abuse** by pregnant women increase the risk.

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- The child is either quite well when put to the bed, or may have only a minor upper respiratory tract infection (cold or snuffles), or minor gastrointestinal disturbance.
  - The post-mortem findings are negative.
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About 15% of cases, some pathological condition may be found,

- Frank pneumonia,
- Congenital heart disease,
- Tracheobronchitis.
- The only constant findings are multiple petechial hemorrhages on the visceral surfaces of the heart, lungs,
- A small amount of milky vomit in the trachea and main bronchi,
- Many infants show froth in the air-passages and facial pallor.
- The lungs show patchy or uniform purplish discoloration of the surface and are firm in consistency with congestion, edema, patchy alveolar collapse.

- The commonly accepted hypothesis suggests that some infants have **prolonged "sleep apnoea"** (a periodic failure to breathe during sleep), which makes them susceptible to hypoxia, which finally leads to bradycardia and cardiac arrest.
- Respiratory infection which adds to the depression of the respiratory centres.
- Nasal edema and mucus secretion may further narrow the small upper respiratory passages

## Other causes of death are

- conduction system anomalies,
- mechanical upper airway obstruction
- adrenal insufficiency,
- gastro-esophageal reflux leading to bradycardia,
- hypersensitivity to cow's milk,
- deficiency of selenium, antibodies, calcium, vitamin D, E, B, magnesium, etc.,
- house mite allergy, anaphylaxis,

- 
- sodium overload in feeds,
  - Hyperthermia or hypothermia,
  - suffocation by bed clothes and pillows,
  - bacterial infection,
  - neurogenic shock,
  - metabolic disorders, etc ..
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THANK YOU  
THANK YOU

*D. Miller*