

FORENSIC PATHOLOGY

Christopher Milroy

MBChB, MD, BA, LLB, LLM, FRCPath, FFFLM,
FRCPC, DMJ

Ottawa Hospital
University of Ottawa

Modern Coroner

- ▣ Modern Coroner role is to supervise death investigation
- ▣ Not to supervise criminal investigation

Modern Coroner

- ▣ In England coroners were elected until 1887
- ▣ Have to be lawyers or medical practitioners
- ▣ In Northern Ireland must be lawyer
- ▣ In Australia are lawyers
- ▣ In British Columbia and USA lay Coroners
- ▣ In Quebec lawyers or medical practitioners
- ▣ In Ontario medical practitioners

Modern Coroner

- ▣ Four (or Five) questions to answer
- ▣ Who
- ▣ Where
- ▣ When
- ▣ How
- ▣ How can be divided into cause and manner of death
- ▣ But may not ask why

Modern Coroner

- ▣ Cause of death is determined by coroner at scene
- ▣ Or after autopsy by pathologist

Modern Coroner

- ▣ Manner of death determined by coroner
- ▣ Natural
- ▣ Accident
- ▣ Homicide
- ▣ Suicide
- ▣ Undetermined

Medical Examiner Systems

- ▣ Dissatisfaction with coroners system resulted in Medical Examiner's system being developed in Massachusetts in 1877
- ▣ First modern system was in New York City in 1918 when pathologist appointed as Chief Medical Examiner
- ▣ Now most states in US have medical examiner systems and a number of Canadian Provinces

Medical Examiners Systems

- ▣ Medical staff
- ▣ Investigators
- ▣ Autopsy staff – as in Coroner's system
- ▣ Administration – as in Coroner's system

Medical Examiners Systems

- ▣ Medical staff
- ▣ Fully qualified Forensic Pathologists
- ▣ Chief of Organization is a Forensic Pathologist
- ▣ Forensic Pathologist determines whether there is to be an autopsy according to specific criteria and individual case selection eg all homicides, death in custody autopsied, sudden unexpected deaths, suicides may be depending on circumstances.

Medical Examiners Systems

- ▣ Death investigators specially trained to carry out scene investigation and death inquiry
- ▣ Report to Medical Examiners

The Forensic Pathologist

- ▣ Who are we
- ▣ Trained in medicine, pathology, then forensic pathology
- ▣ Ontario is following this idea with a register of Forensic Pathologists – most relevant when large population with need to maintain standards
- ▣ Smaller provinces usually only have one or two offices.

The role of the Forensic Pathologist

- ▣ Conduct autopsies on suspicious deaths
- ▣ Examine injuries, including living victims of serious crime
- ▣ Prepare and give evidence in court
- ▣ Called by prosecution and defence

Forensic Methodology

- ▣ History
- ▣ Scene
- ▣ External Examination
- ▣ Internal Examination
- ▣ Ancillary investigations
- ▣ Opinion

INJURIES

- ▣ ABRASIONS
- ▣ BRUISES
- ▣ LACERATIONS
- ▣ INCISED/STAB WOUNDS
- ▣ BURNS
- ▣ FIREARMS



TYPES OF INJUREIS

- ▣ ABRASIONS
- ▣ SUPERFICIAL INJURIES
- ▣ DO NOT BLEED



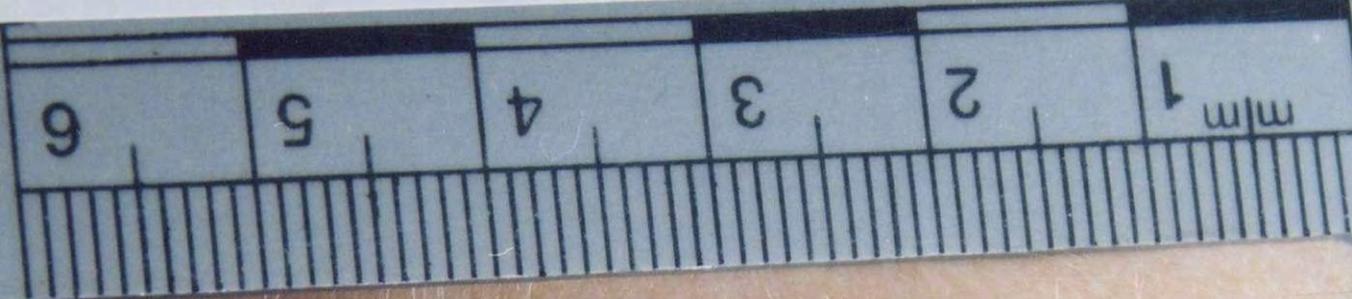




Binding injuries



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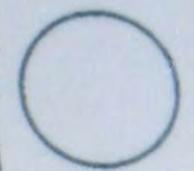
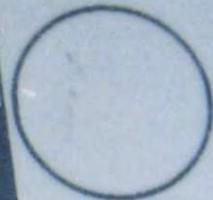
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Bruises

- ▣ Also called contusions, ecchymoses
- ▣ Dating of bruises difficult
- ▣ May be patterned
- ▣ Petechia (petechiae) important form of bleeding













Lacerations

- ▣ Splitting or tearing of the skin caused by blunt trauma.
- ▣ A laceration is a wound in law



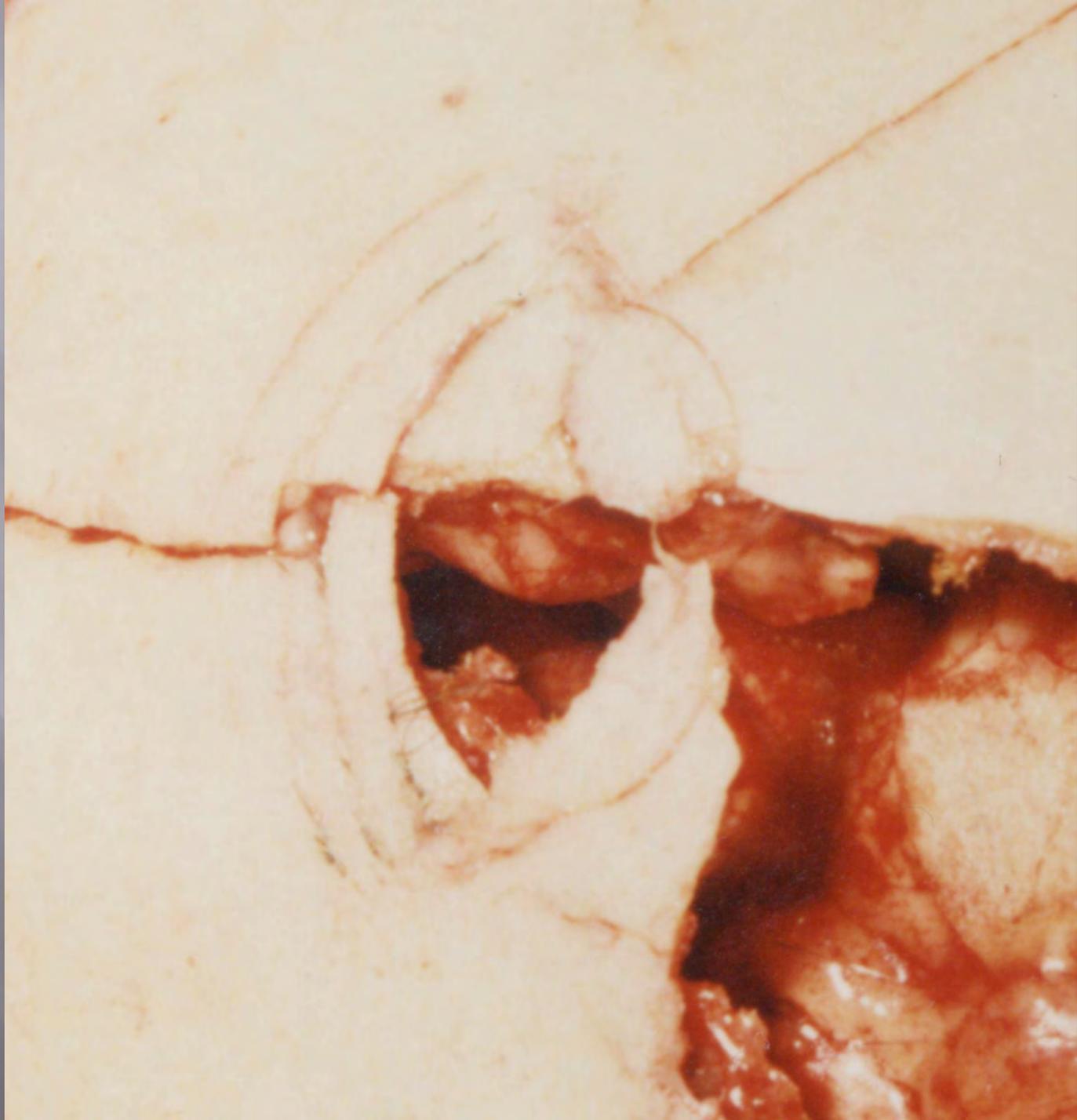














STABBING INJURIES

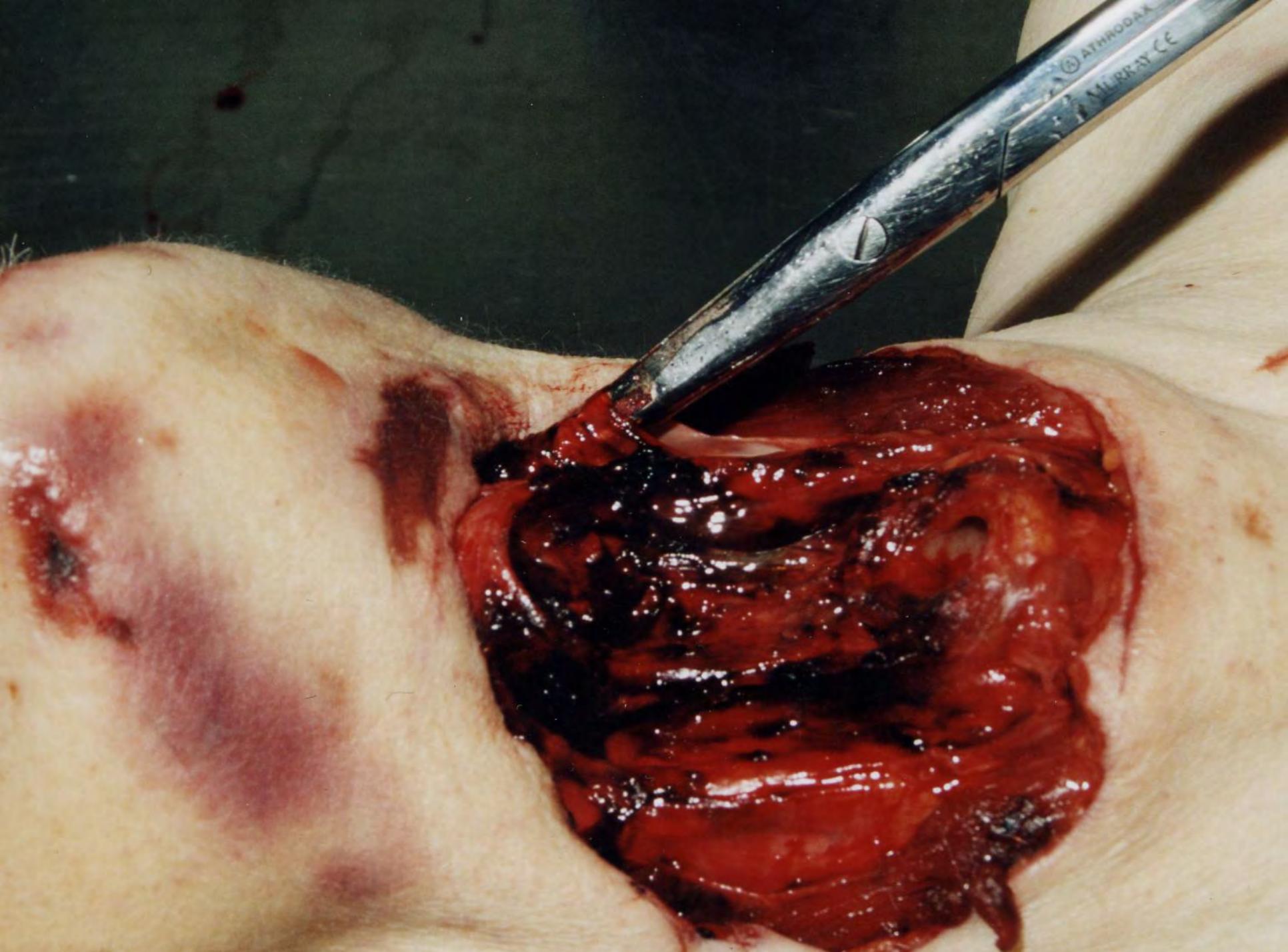
- ▣ COMMONEST PENETRATING WOUND - THEY ARE NOT LACERATIONS
- ▣ MOSTLY KITCHEN KNIVES





STAB AND INCISED WOUNDS

- ▣ SUICIDAL STAB WOUNDS MAY BE MULTIPLE AND MAY NOT BE ASSOCIATED WITH TENTATIVE INJURIES
- ▣ RARELY SUPERFICIAL WOUNDS FROM AN ASSAILANT MAY MIMIC TENTATIVE WOUNDS



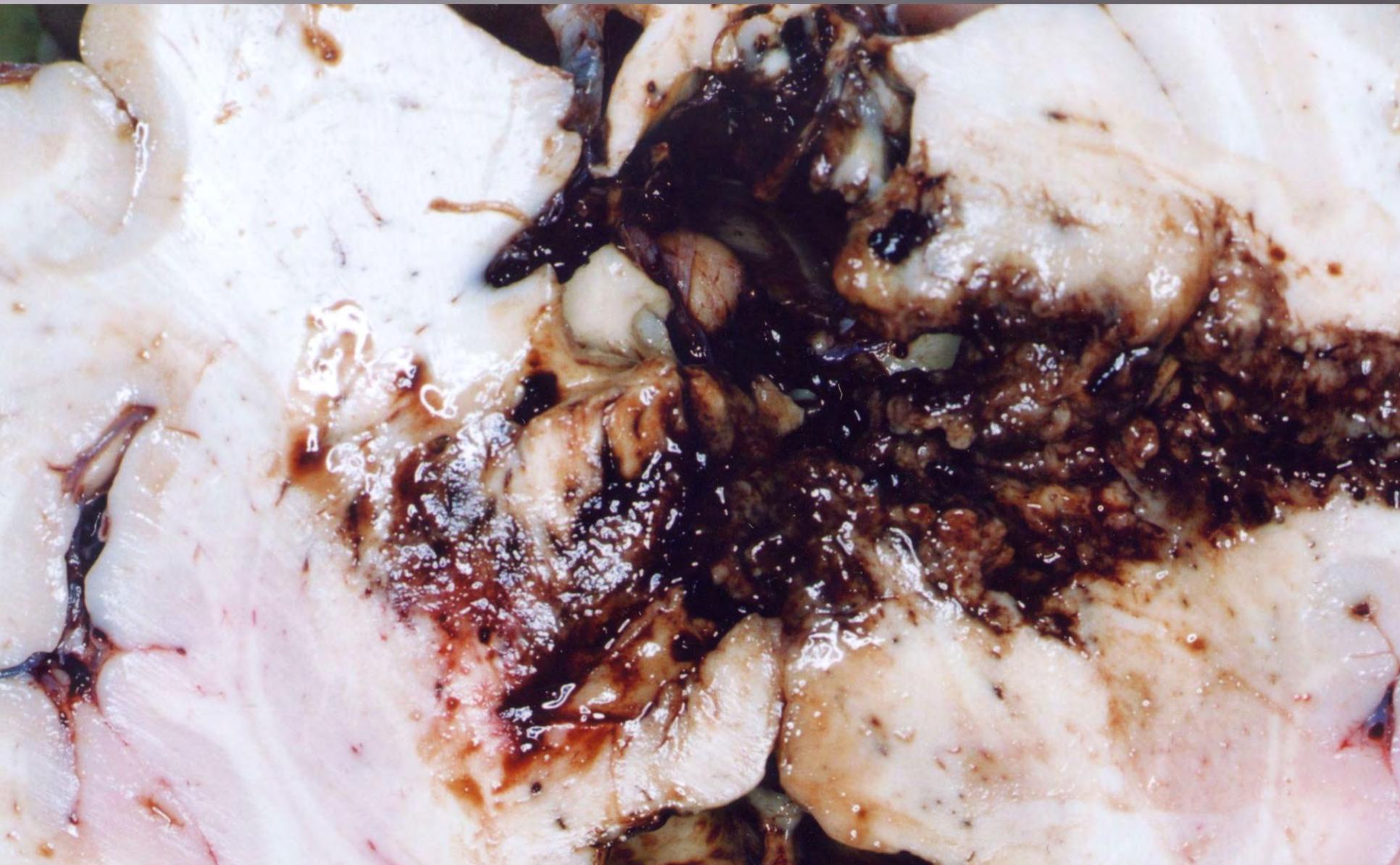
STABBING INJURIES

- ▣ UNUSUAL WEAPONS ALSO USED
- ▣ CHISEL















BURNS

- ▣ SCALDS
- ▣ DRY HEAT
- ▣ ACID
- ▣ ELECTRICITY
- ▣ CIGARETTE BURNS



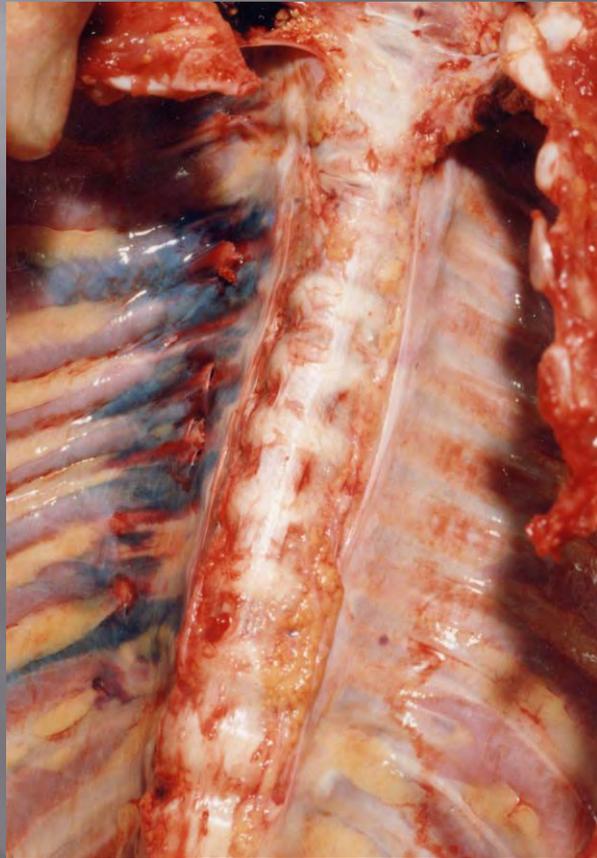






Child abuse





Fractured ribs



Child abuse - radiology



Child abuse - radiology



Typical Forensic Pathology Issues



▣ When Inflicted ?

Typical Forensic Pathology Issues

- ▣ Activity of victim



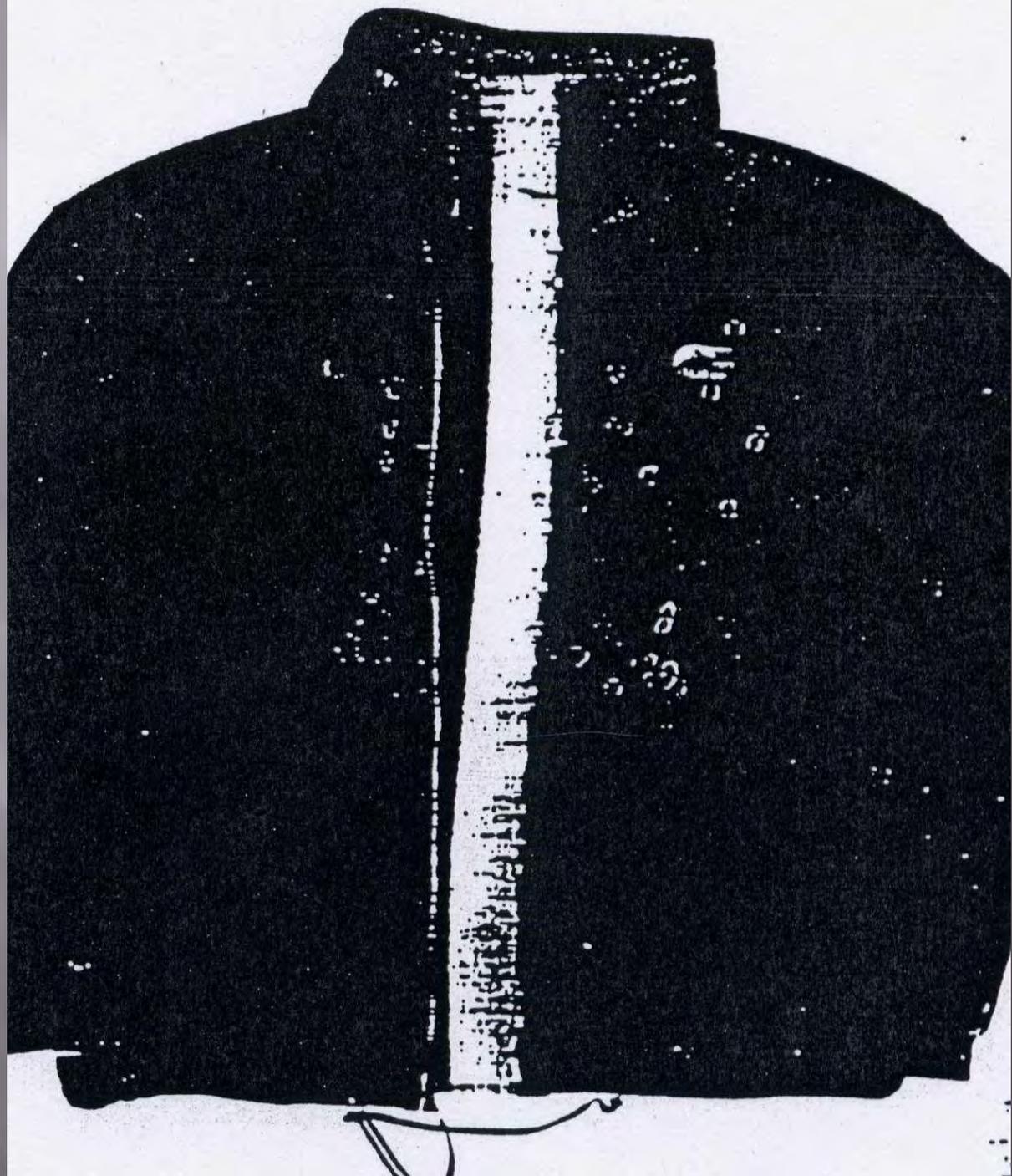
Typical Forensic Pathology Issues

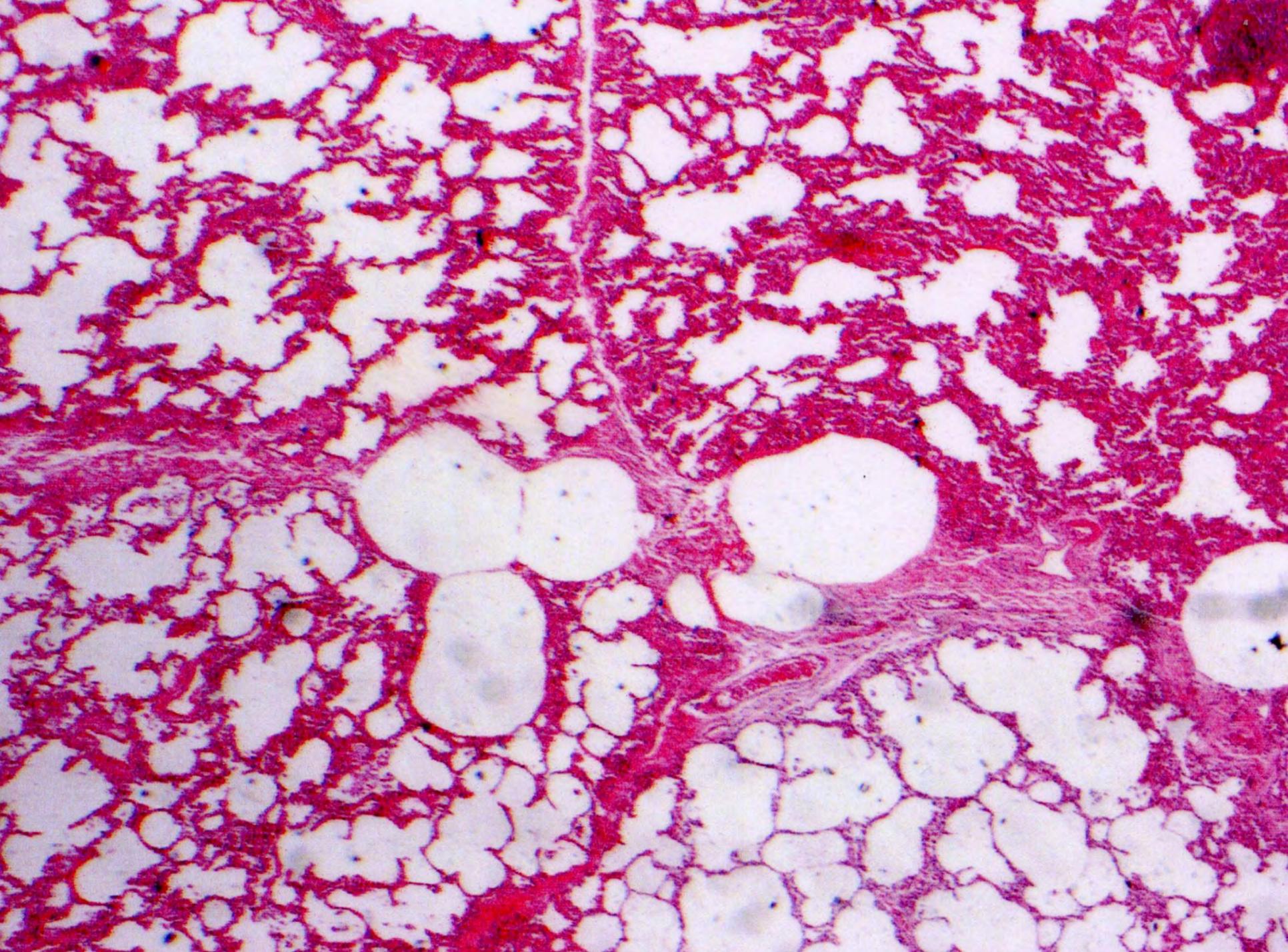


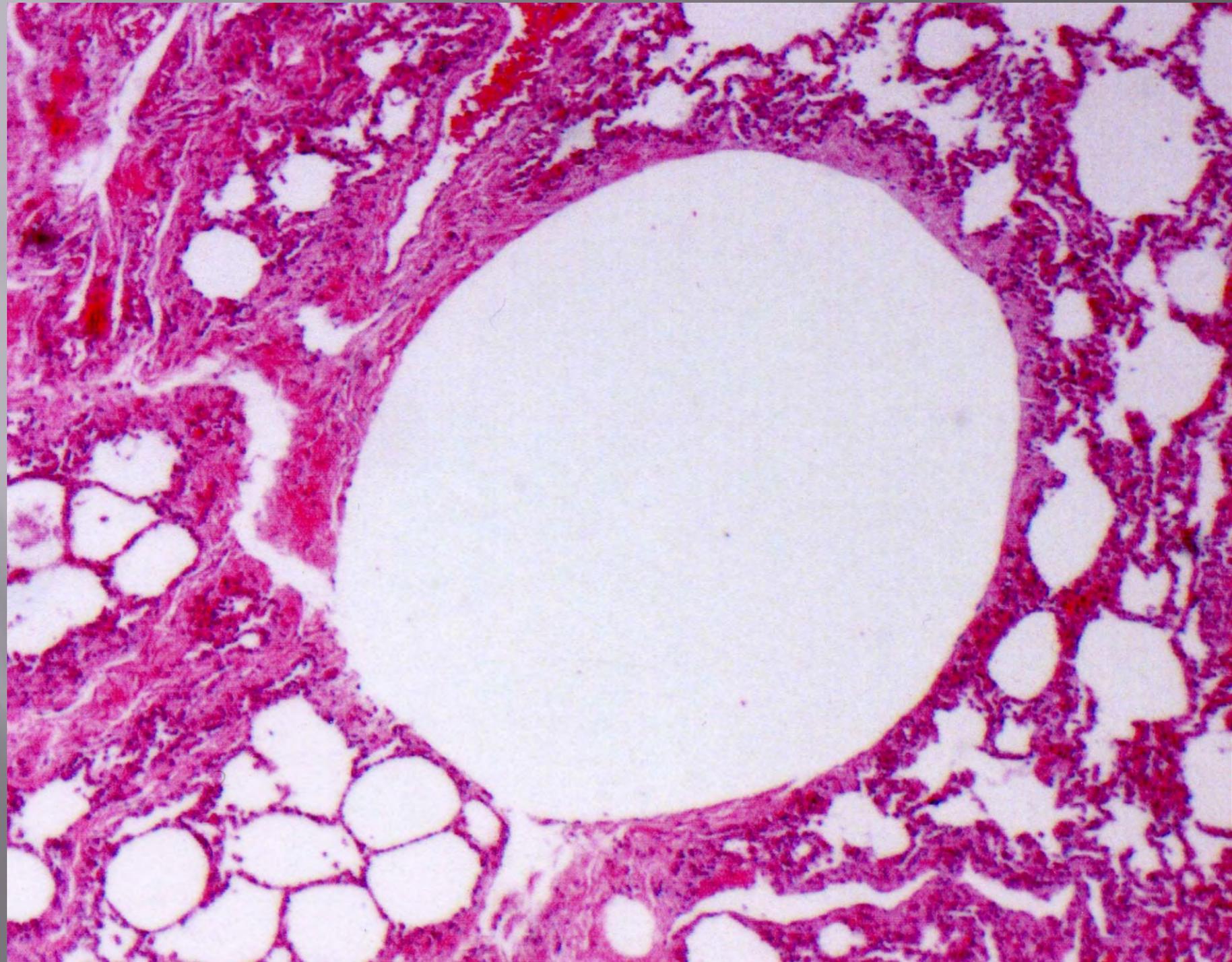
- ▣ Interpretation with Forensic Scientists



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Misinterpretation?



- ❑ Called stabbed wounds by first pathologist
- ❑ Mother charged with murder
- ❑ Challenged by subsequent experts
- ❑ First pathologist stated no more dog bites than polar bear bites !

Misinterpretation?



- ▣ Also on other areas of body as well as other side of neck
- ▣ Pit bull terrier seen leaving the scene !

“ASPHYXIA”

Christopher Mark Milroy
Forensic Pathologist, Ottawa Hospital and Professor,
University of Ottawa, Canada

What is asphyxia?

- ▣ Asphyxia is derived from the ancient Greek and literally means absence of the pulse
- ▣ Has come to mean deaths associated with deprivation of oxygen

What is asphyxia?

- ▣ A broad range of deaths is covered by this definition and includes : -
- ▣ Strangulation
- ▣ Smothering
- ▣ Suffocation
- ▣ Choking
- ▣ Restraint/Positional asphyxia
- ▣ Traumatic asphyxia
- ▣ Poisoning by certain substances

The “classic signs of asphyxia”

- ▣ Congestion
- ▣ Cyanosis
- ▣ Petechiae
- ▣ Dilatation of the right side of the heart
- ▣ Fluidity of blood

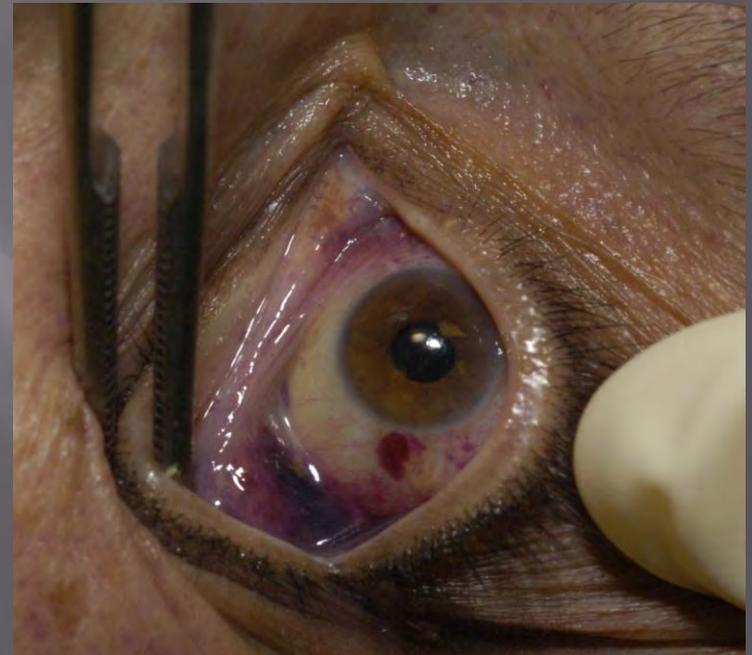
Petechiae

- ▣ Result from raised intravascular pressure
- ▣ Arise from venules - capillaries are too small



Petechiae

- ▣ In some cases of strangulation scleral haemorrhage may be seen.



Petechiae

- ▣ May be seen in mouth and behind ears



Petechiae

- ▣ Relevant when in context
- ▣ In association with injuries and above the level of compression





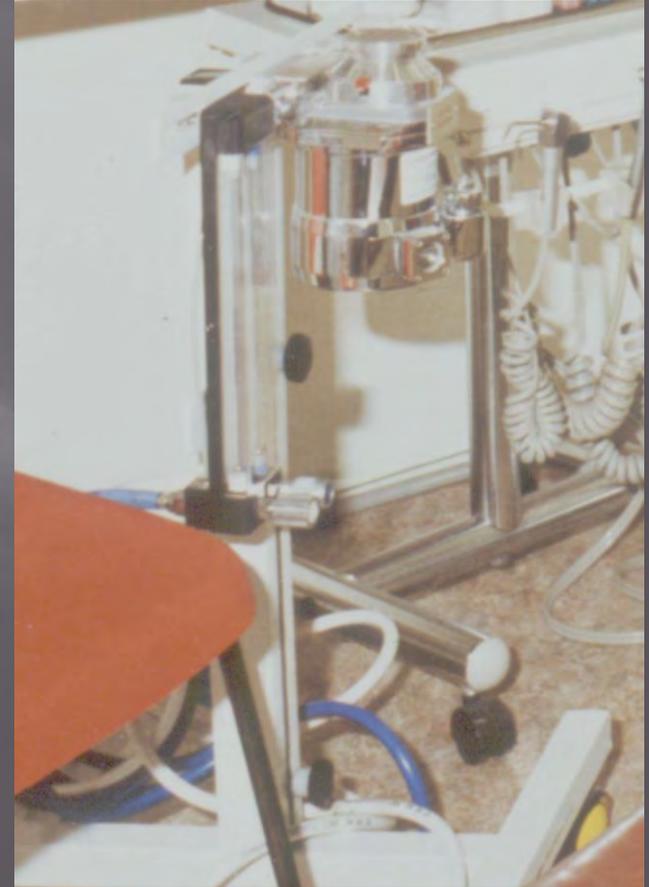






Suffocation

- ❑ 14 year old boy with Goldenhar's syndrome (abnormalities of jaw, cervical vertebrae, ears)
- ❑ Attended dentist
- ❑ Collapsed during anaesthetic
- ❑ At autopsy no positive findings apart from Goldenhar's syndrome



Suffocation

- ▣ The nitrous oxide and oxygen pipes had been reversed
- ▣ When the boy became unwell he was given 100% oxygen
- ▣ In fact he received 100% nitrous oxide
- ▣ Therefore a pure asphyxial death with no signs of asphyxia

Sufocation

- ▣ May be seen in environments with reduced oxygen
- ▣ Or increased Carbon dioxide
- ▣ Method of suicide recommended by certain euthanasia supporters
- ▣ Scene examination is central to these investigations

Suicide with Helium



Upper airway obstruction

- ▣ Not a difficult diagnosis when the obstructing material still present



Smothering

- ▣ Injuries are rare

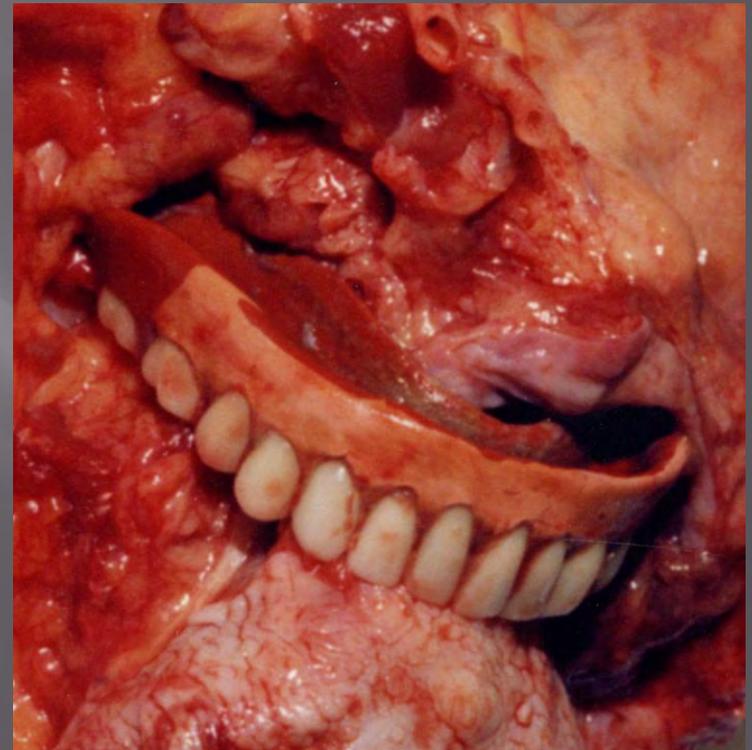


Choking



Choking

- ▣ 87 year old woman beaten by her son
- ▣ At autopsy dentures found impacted across larynx



Compression of the neck

- ▣ Manual strangulation
- ▣ Ligature strangulation
- ▣ Hanging
- ▣ Armlock



Mechanisms of death in compression of the neck

- ▣ Obstruction of the vasculature with compression of the jugular veins and carotid arteries
- ▣ Obstruction of airway
- ▣ Vaso-vagal inhibition

Mechanisms of death in compression of the neck

- ▣ Obstruction of the vasculature appears to be the most common mechanism. This is because the pressures required to obstruct the vasculature are less than to obstruct the airway. It has been stated that it requires 3 times as much force to occlude the trachea as it does to obstruct the carotid arteries.

Mechanisms of death in compression of the neck

- ▣ Vaso-vagal inhibition is said to occur when the vagus nerve and/or the carotid sinus is stimulated causing the heart rate to slow significantly or stop.

Manual strangulation

- ▣ External signs may be subtle - just a few abrasions and bruises
- ▣ Abrasions may be from victim attempting to pull compressing object from neck - hands, ligature etc

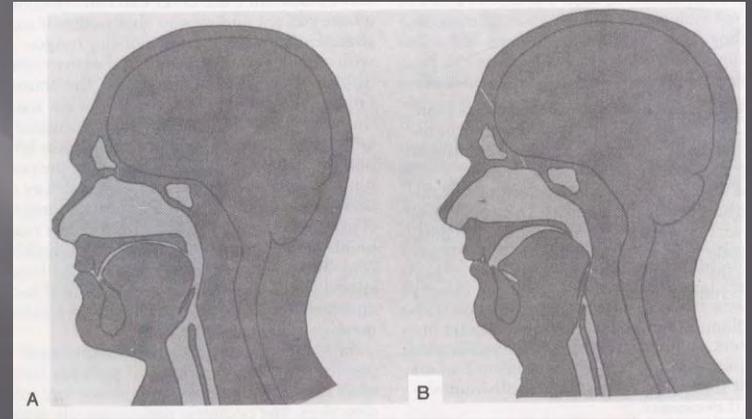


Mechanisms of death in compression of the neck

- ▣ Obstruction of the airway either by
 - a) collapse of the trachea
 - b) causing the posterior portion of the tongue to move backwards and upwards

“Swallowing the tongue”

- ▣ Airway becomes occluded by position of posterior tongue in relation to posterior wall of the pharynx
- ▣ If person face up more compromised



Internal findings

- ▣ Bruising variable
- ▣ More common in manual strangulation
- ▣ Often no changes in hanging





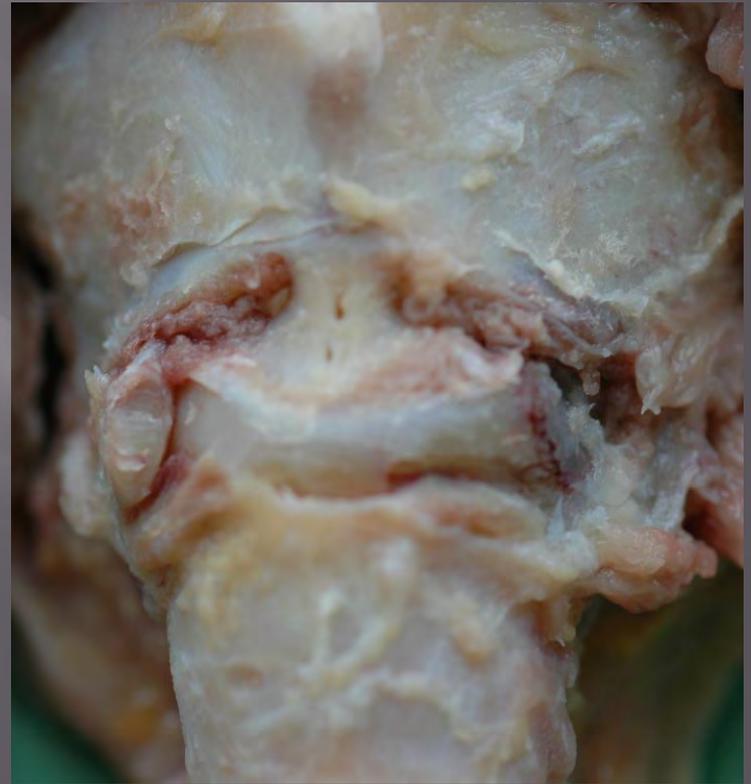
Laryngeal changes

- ▣ Rare in young - cartilage to flexible



Laryngeal changes

- ▣ Fractured cricoid cartilage rare









Artefacts in the neck

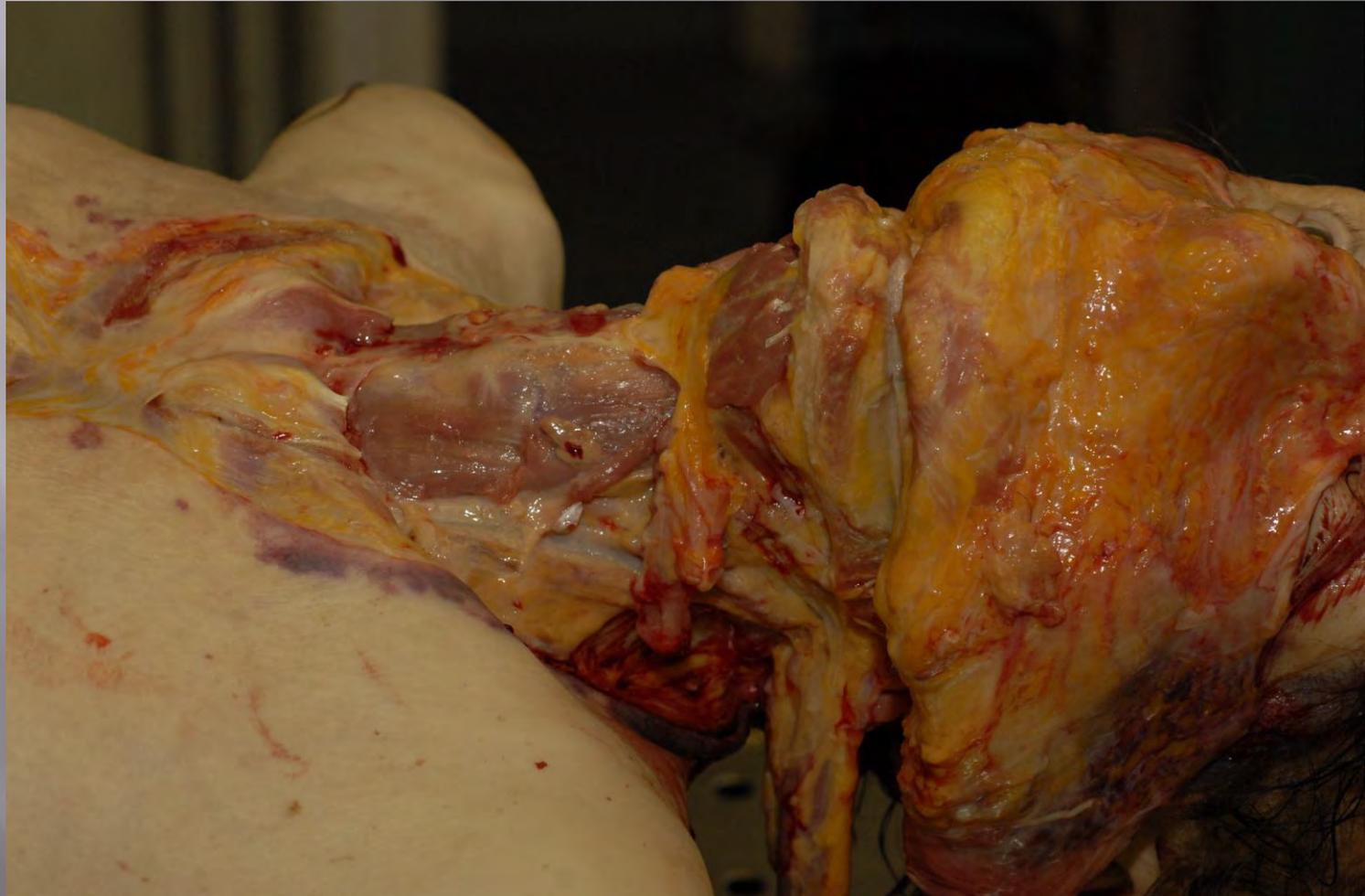
- ▣ Bruising may be produced by dissection technique
- ▣ Remove brain first and drain neck of blood by removing the thoracic organs.
- ▣ Dissect muscles in situ - layer dissection of neck

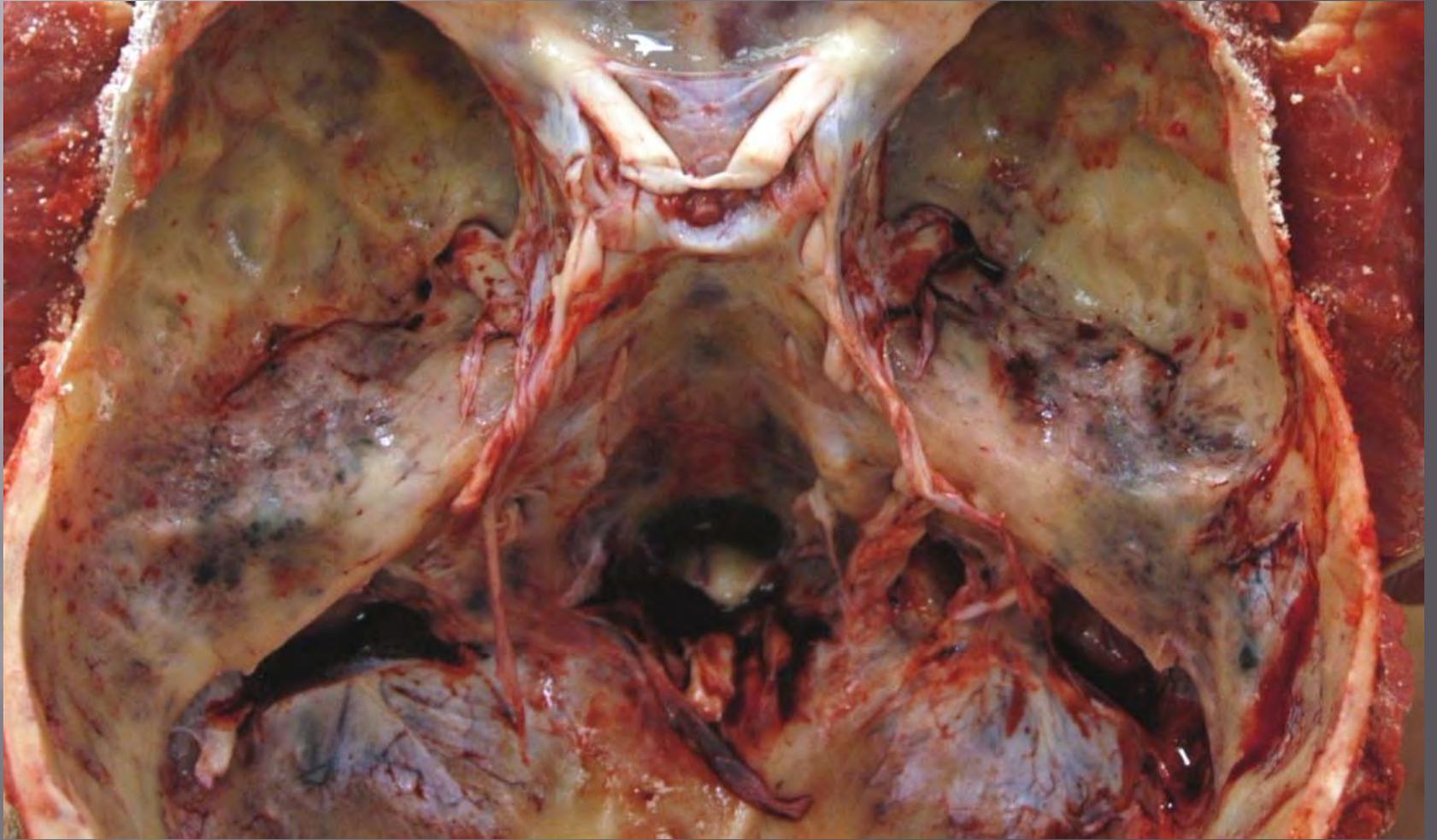






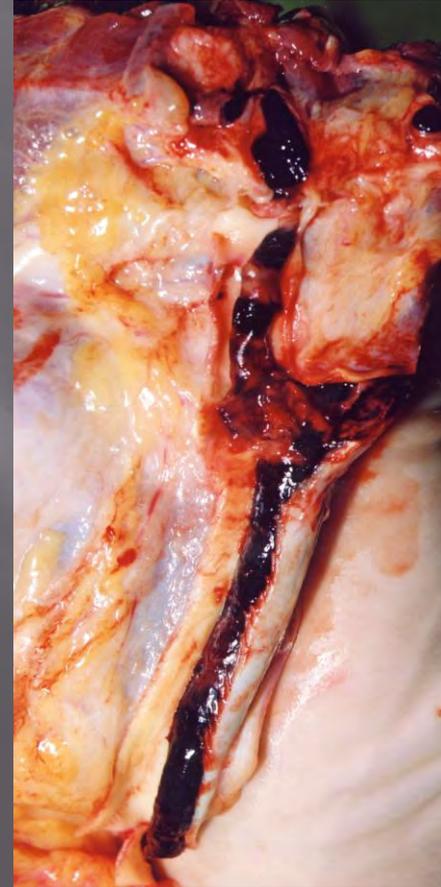






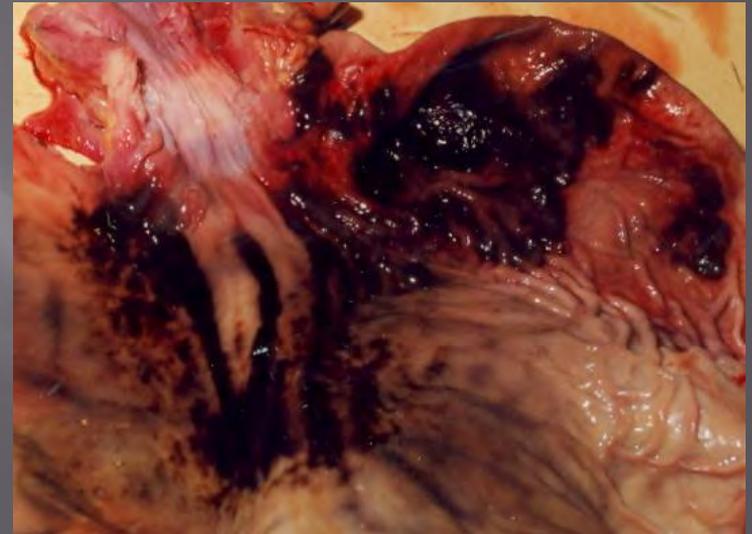
Late complication

- ▣ Compression of neck may rarely be followed by carotid thrombosis

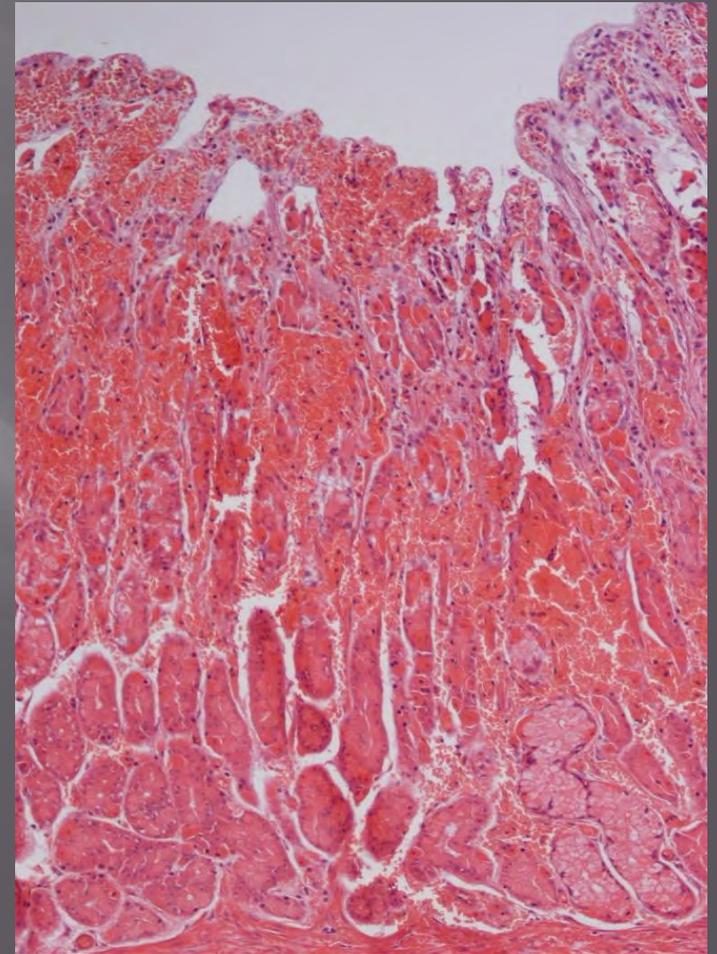
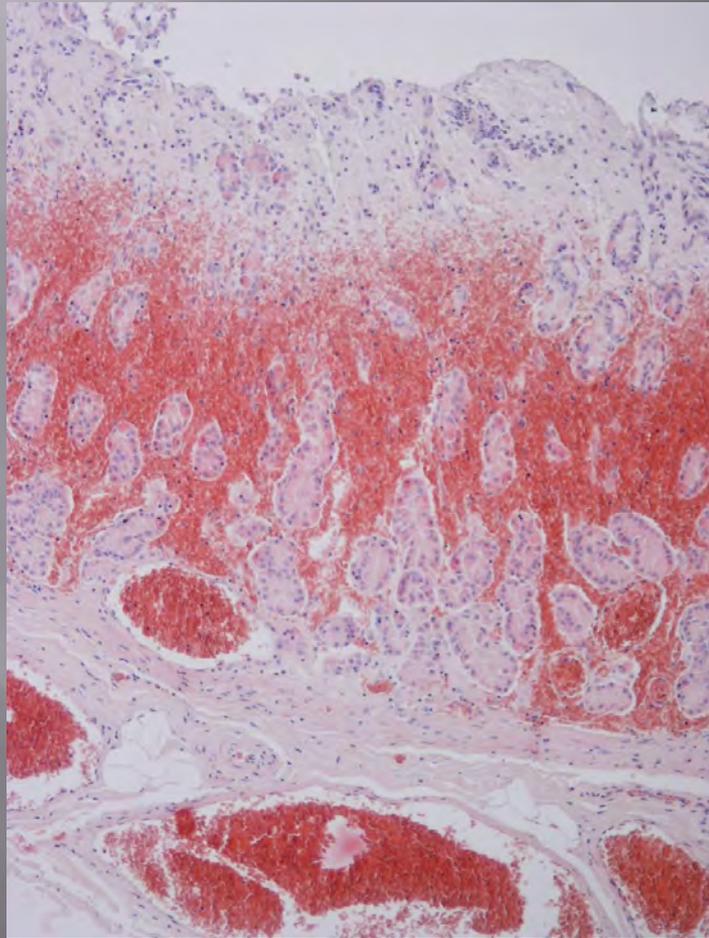


Cyanide poisoning

- ▣ May have pink/red hypostasis
- ▣ Cyanide salts are gastric irritants
- ▣ 46 year old woman collapsed on holiday in Egypt. Body returned to UK and autopsied
- ▣ Cyanide identified on toxicology
- ▣ Partner convicted of murder



Cyanide poisoning

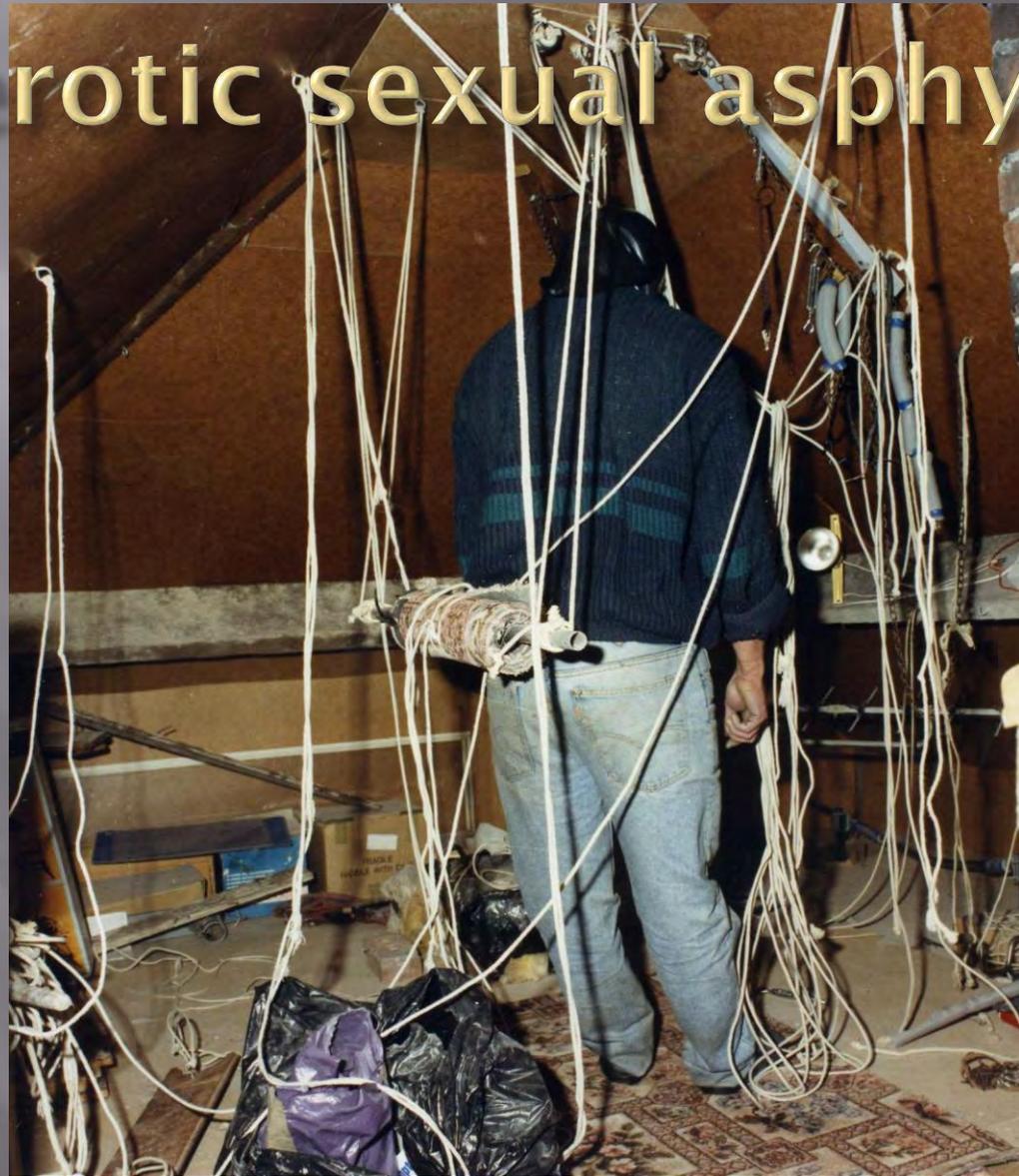


Hanging

In hanging ligature can be horizontal and difficult to distinguish from homicide



Auto-erotic sexual asphyxia



Positional asphyxia

- ▣ Arises when position of person prevents proper respiration



Deaths during restraint

- ▣ In USA in 1980's deaths began to be seen in which people with confused behaviour died during physical restraint by the police.
- ▣ At autopsy there were often no significant findings to account for death. Toxicology revealed use of cocaine
- ▣ Initially these deaths were believed to be due to positional asphyxia caused during the restraint

Deaths during restraint

- ▣ Subsequent research has indicated that there is no significant loss of respiratory function in people restrained face down or hog tied. Even with a knee placed on the back, whilst there was a reduction in respiratory function, it was not significant.
- ▣ These deaths are essentially due to the underlying condition, most commonly cocaine intoxication, but with psychiatric disorders also occasionally associated with death during restraint

WOUND BALLISTICS

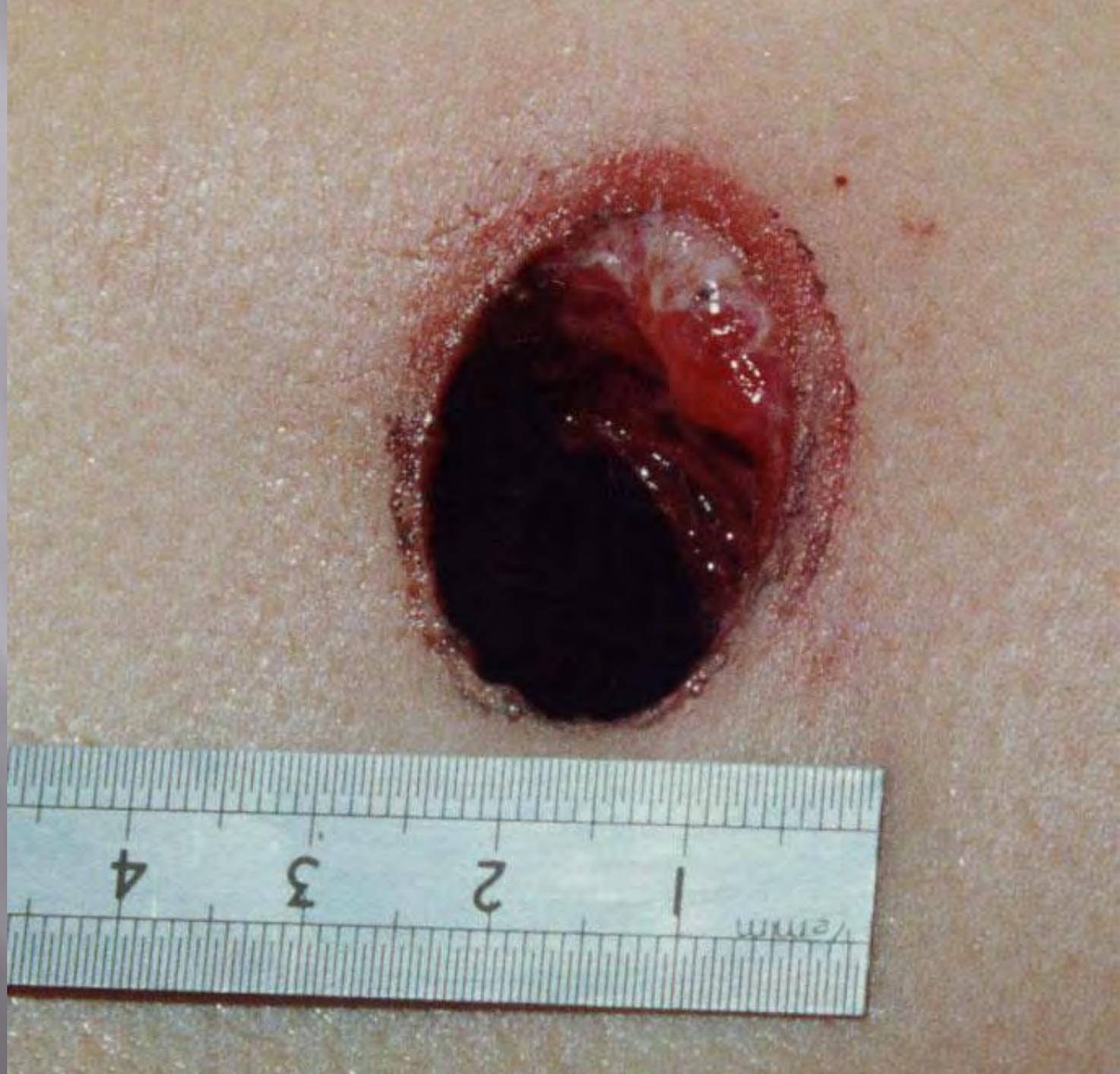
TYPES OF WEAPON

- ▣ SMOOTH BORE
 - ▣ A) SHOTGUNS
 - ▣ B) AIR POWERED WEAPONS
- ▣ RIFLED WEAPONS
- ▣ OTHER E.G. CROSSBOWS

SHOTGUNS

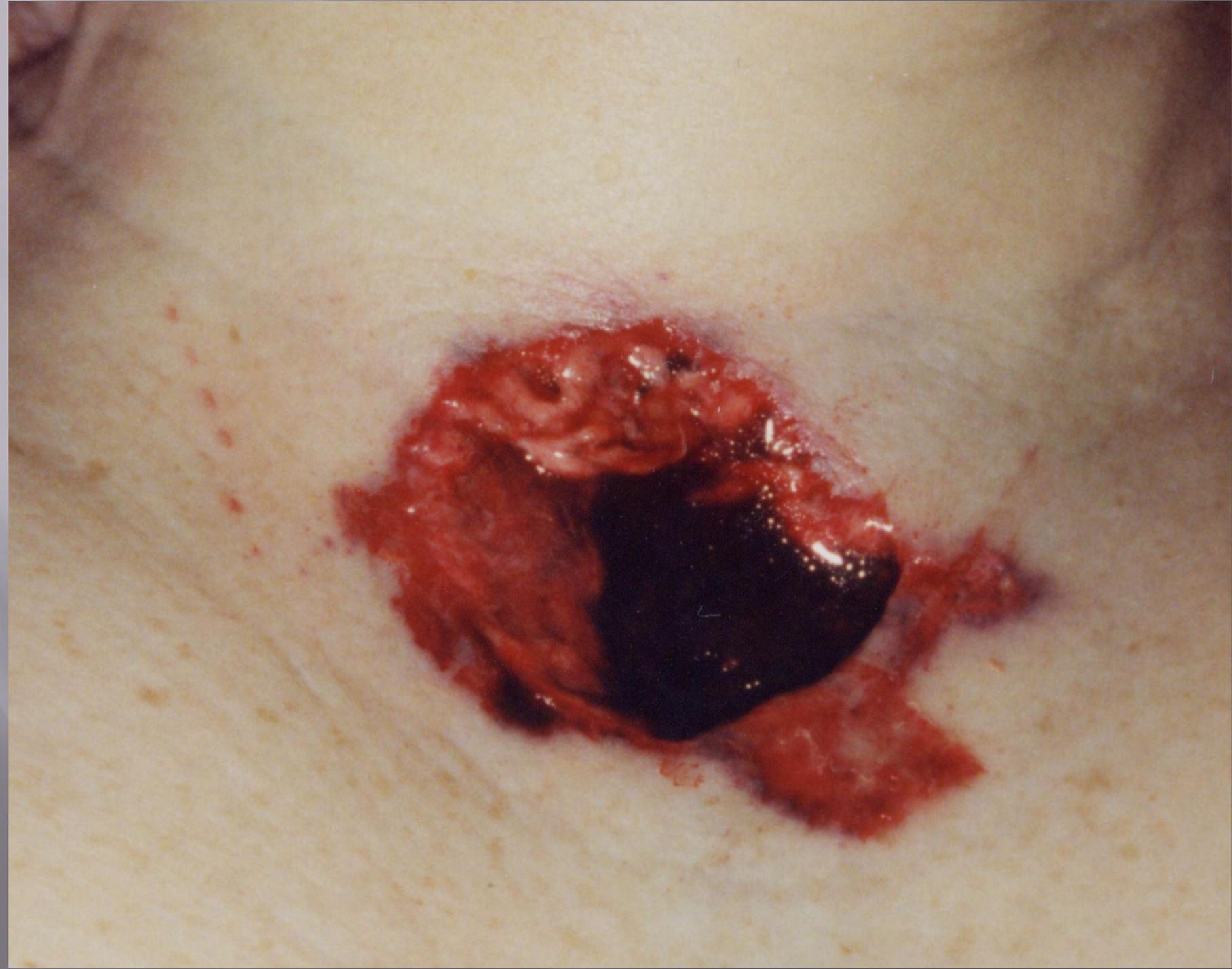
- ▣ COMMON WEAPON
- ▣ MAY DISCHARGE SINGLE SHOT OR MULTIPLE SHOTS
- ▣ POPULAR WEAPON FOR HOMICIDE AND SUICIDE









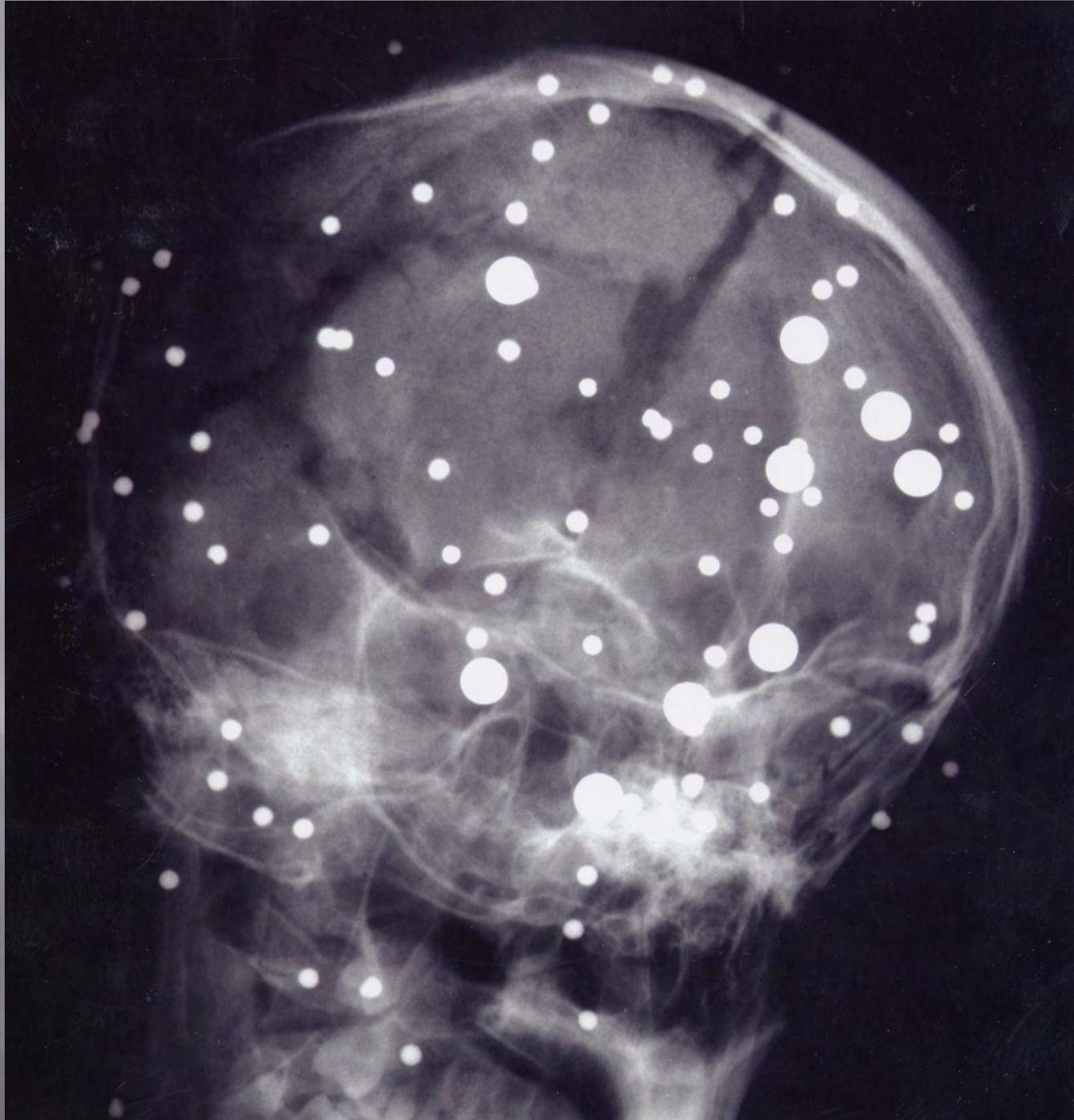
















FIREARMS



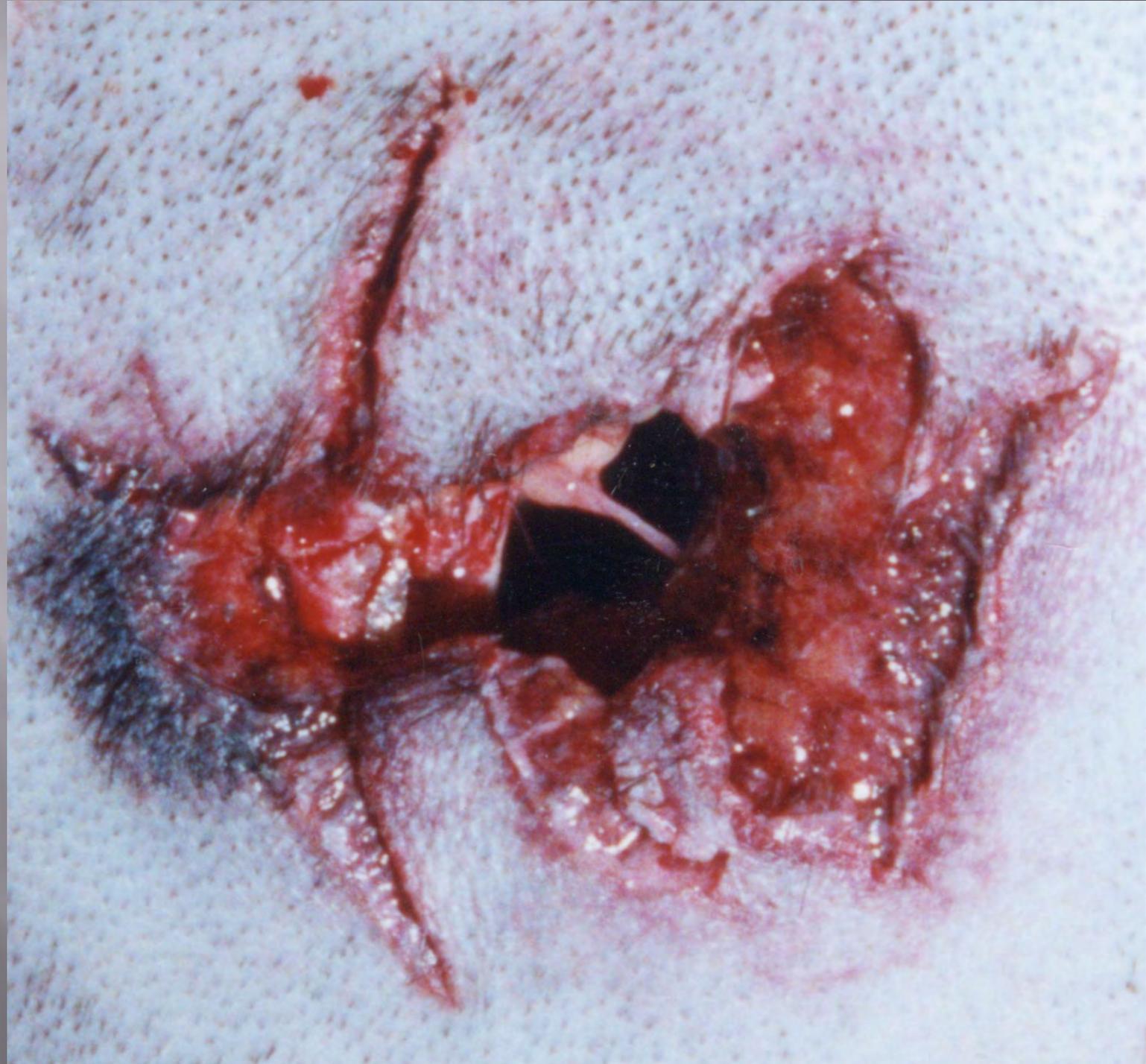
INCREASE IN
FIREARMS
LOW VELOCITY
WOUNDS
DAMAGE IN
WOUND TRACK
ONLY









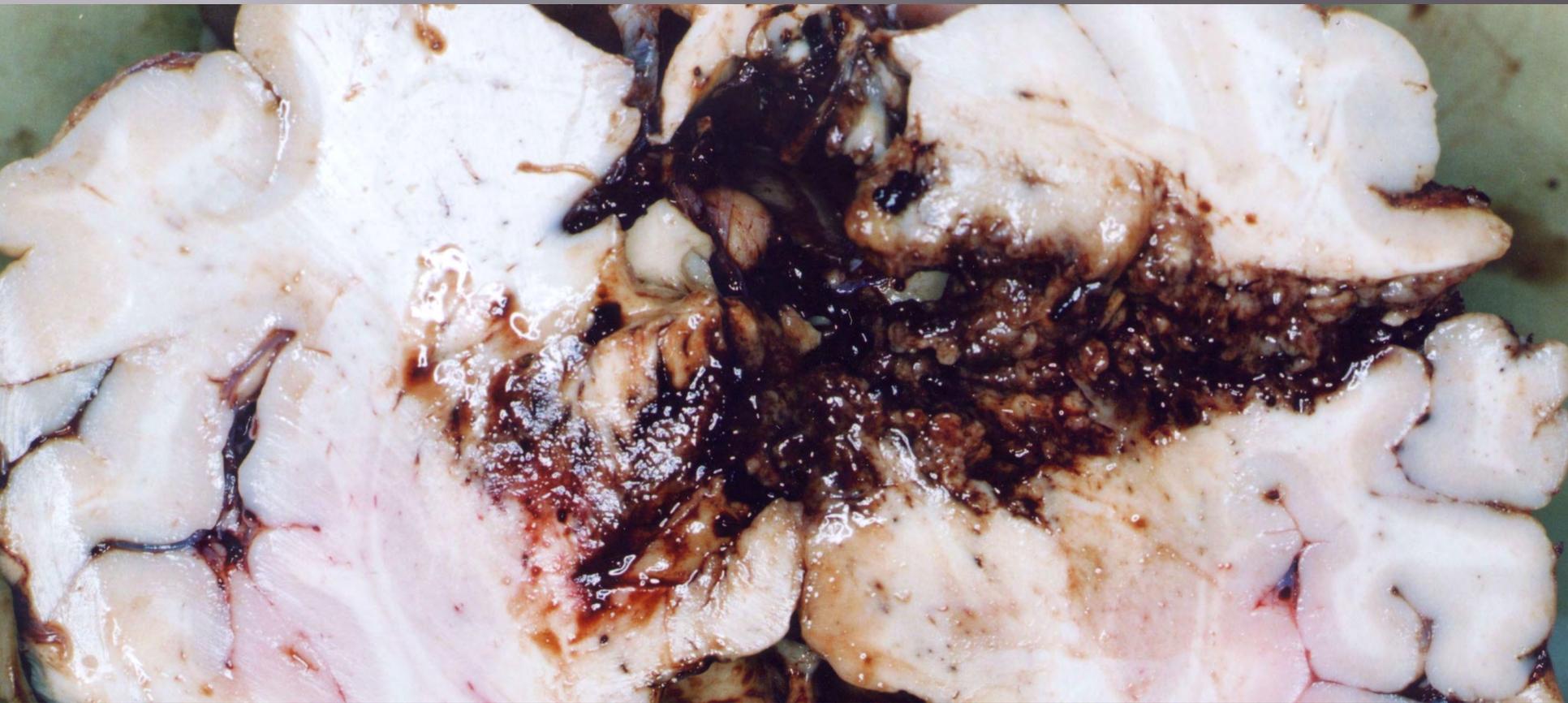




















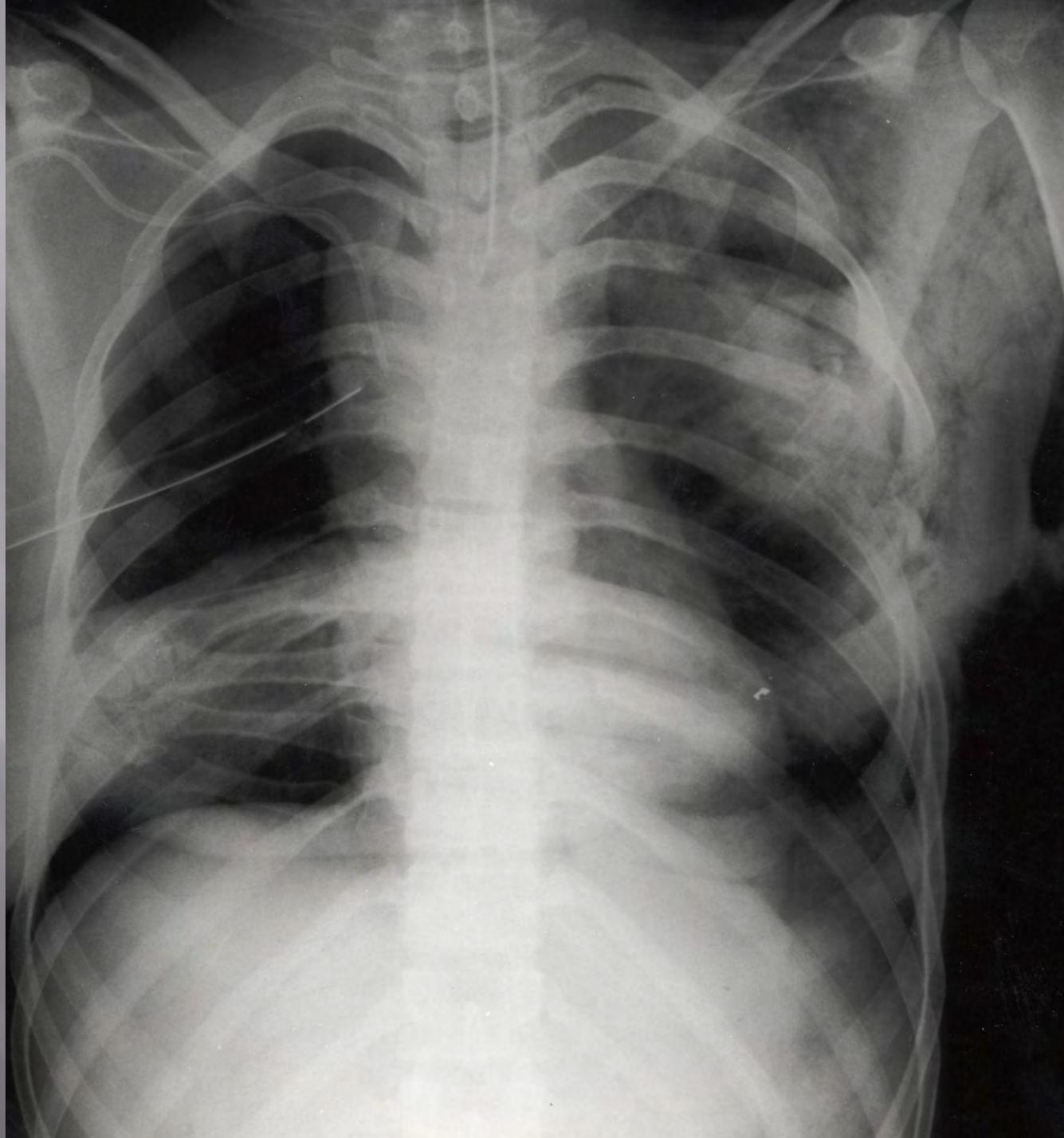


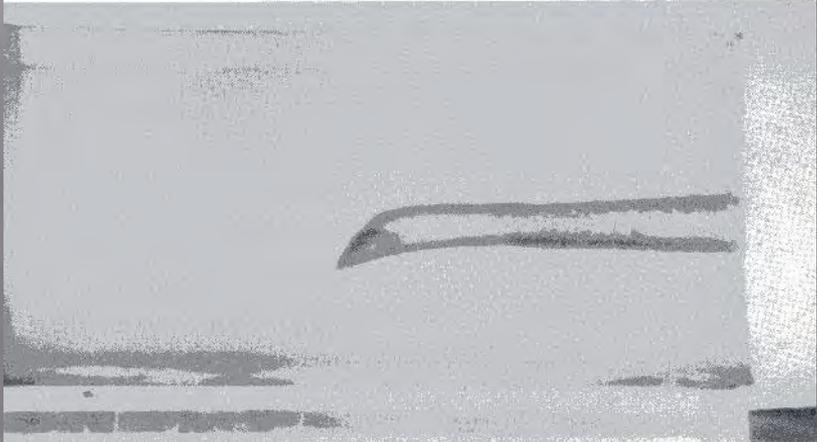


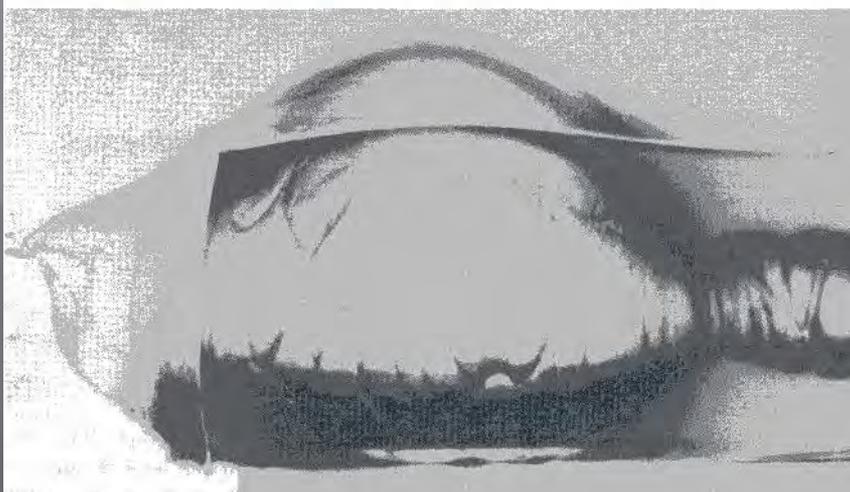
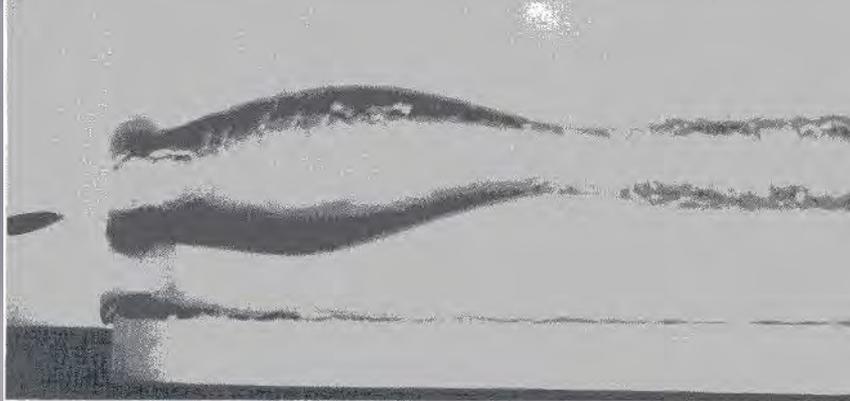


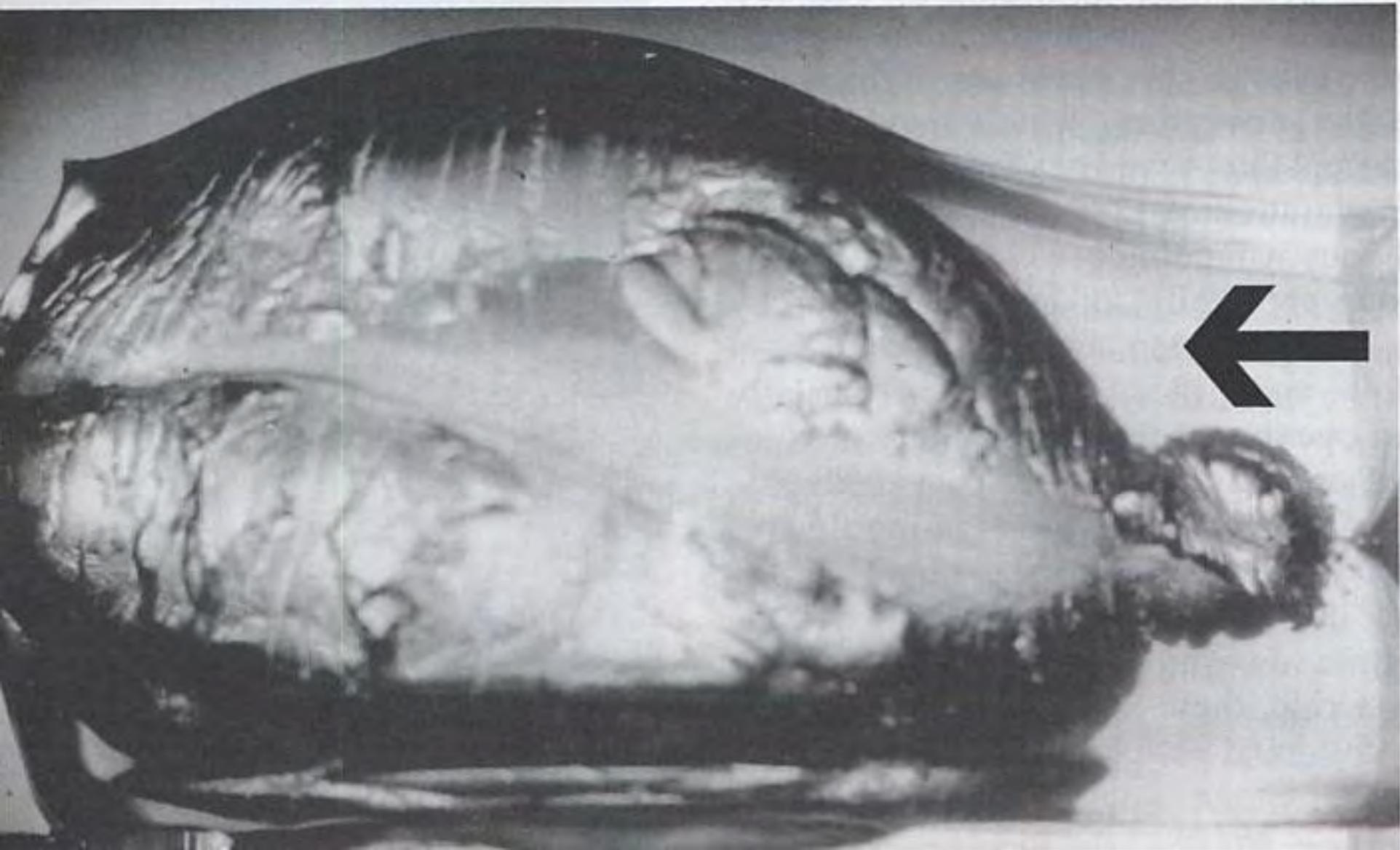


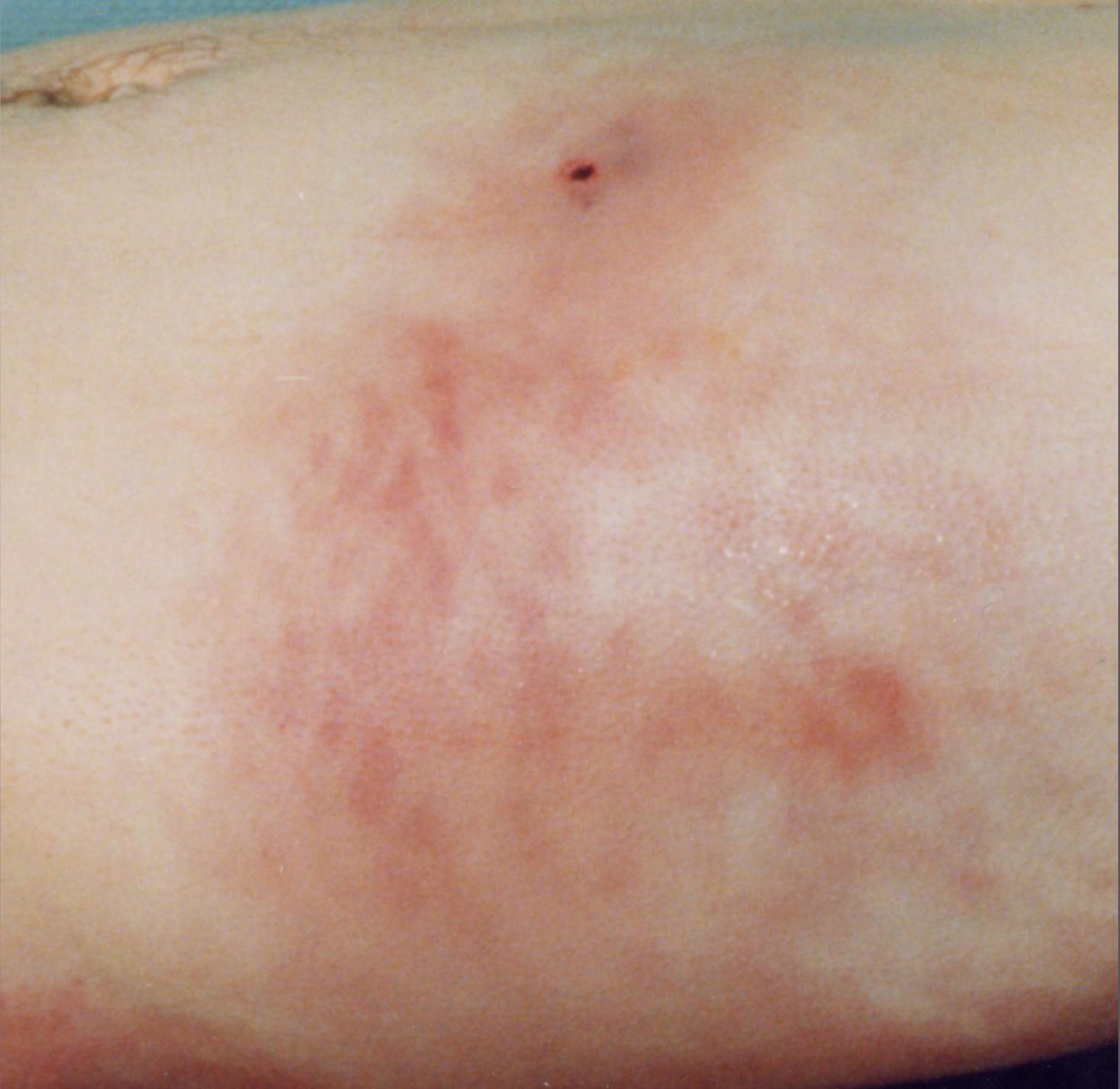
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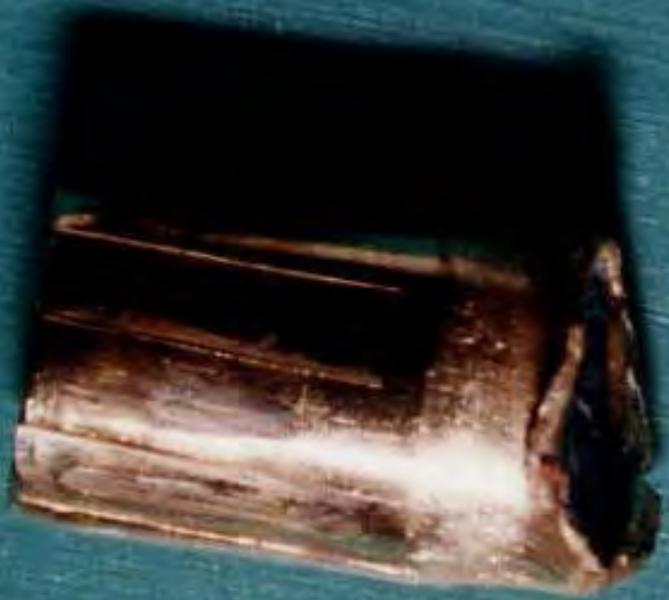
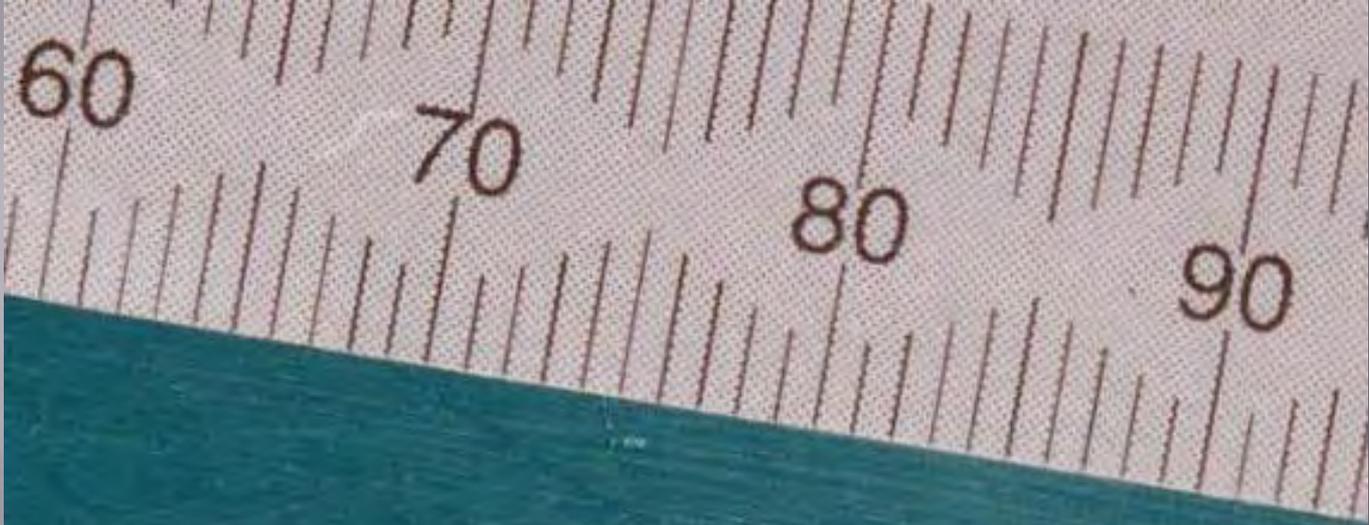




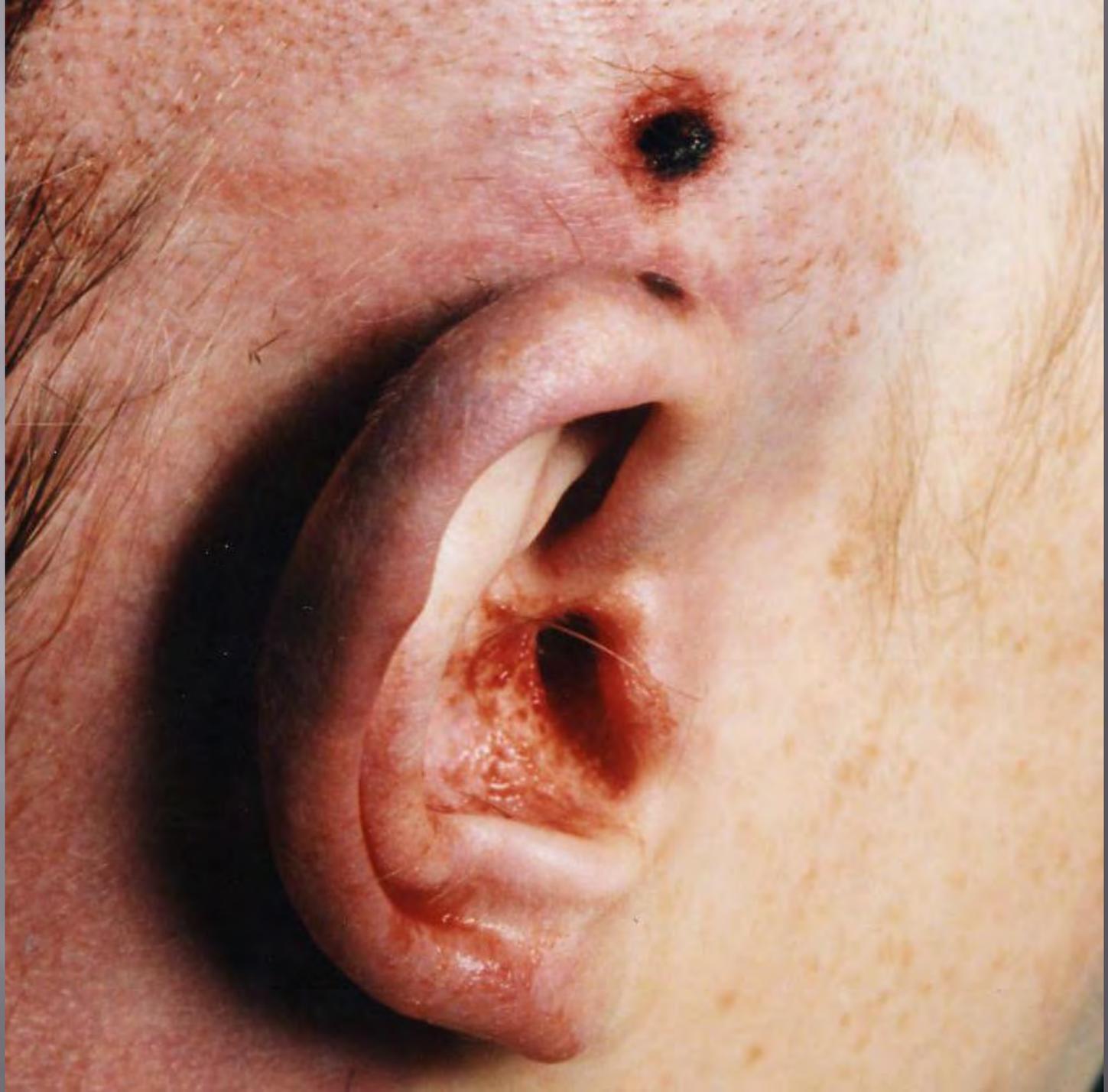


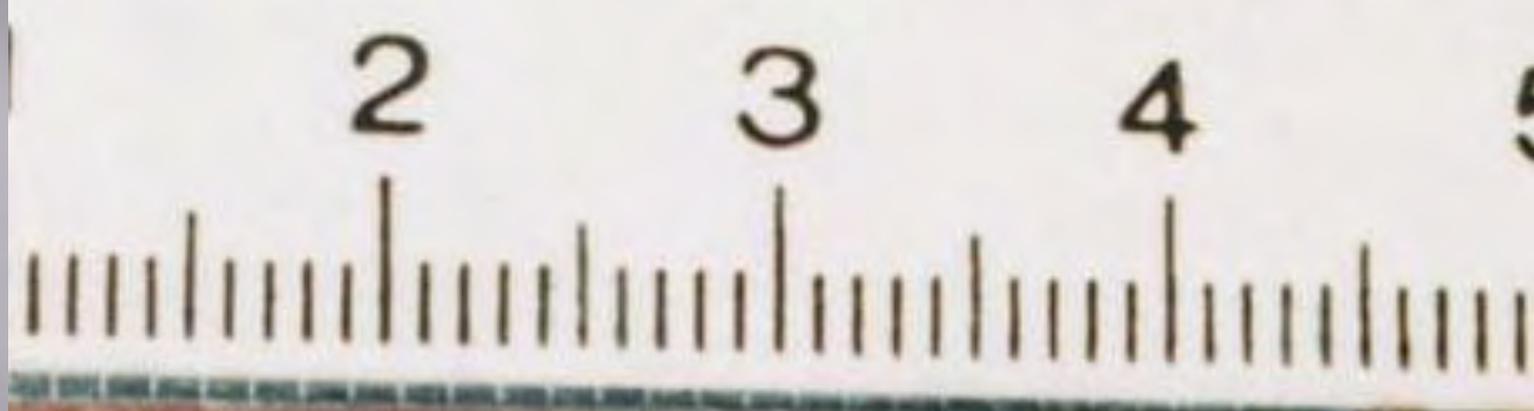


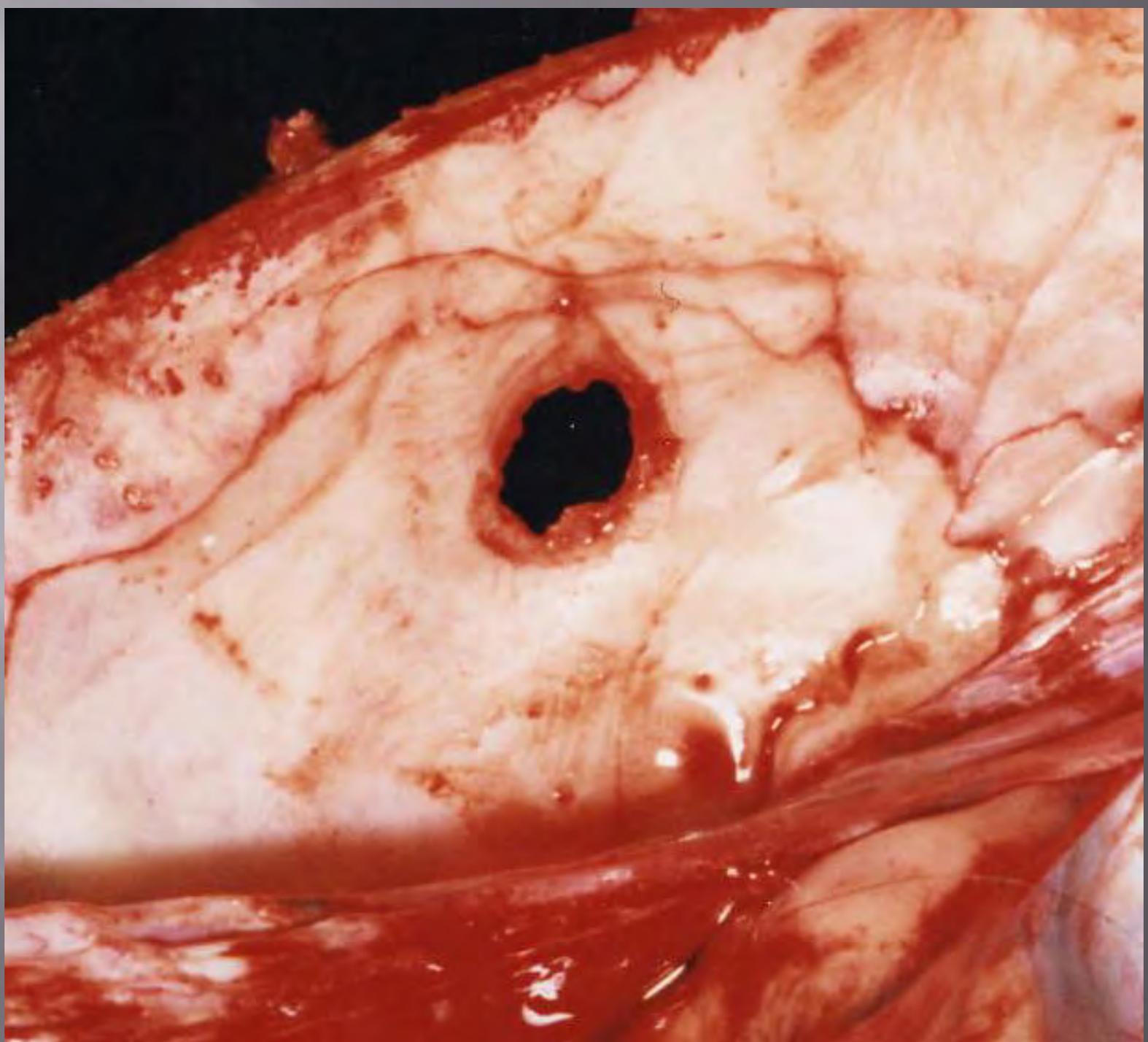
































Toxicology of MDMA

	MDMA Deaths (N=13)	Mixed drug deaths (N=22)	Trauma (N=24)	
Range	0.478- 53.9 mg/l.	0.04- 41.5 mg/l	0.035- 4.81 mg/l	
Mean	8.43 mg/l	2.90 mg/l,	0.862 mg/l	
Media n	3.49 mg/l.	0.76 mg/l	0.483 mg/l	



English Law of Homicide

- ❑ Murder
- ❑ Common law offence
- ❑ Coke's Definition - Murder is when a man of sound memory, and of the age of discretion, unlawfully killeth within any country of the realm any reasonable creature in rerum natura under the King's peace, with malice aforethought, either expressed by the party or implied by law, so as the party wounded, or hurt, etc. die of the wound or hurt, etc. within a year and a day after the same
- ❑ Year and a day rule abolished in 1996
- ❑ Mens Rea is the intention to kill or do serious harm

English Law of Homicide

- ▣ Murder may be reduced to manslaughter at common law by provocation. Now defined by Homicide Act 1957
- ▣ Statute law introduced concept of Diminished Responsibility in Homicide Act 1957

English Law of Homicide

- ▣ Manslaughter de novo, known as Involuntary manslaughter can be divided into: -
- ▣ A) Intentional act manslaughter whether by commission or omission - also called constructive manslaughter
- ▣ B) Gross negligence manslaughter

English Law of Homicide

- ▣ A) Intentional act manslaughter whether by commission or omission
- ▣ Typical scenario seen by the Forensic Pathologist is a man punched by another who falls backwards, striking his head on the ground with contusional damage and subdural haematoma.

English Law of Homicide

- ▣ Base offence can be for example
 - ▣ (a) Common assault
 - ▣ (b) Assault occasioning actual bodily harm
 - ▣ (c) Recklessly or wilfully causing grievous bodily harm
 - ▣ (d) Public order offences affray, violent conduct
 - ▣ (e) Administration of a noxious thing
 - ▣ (g) Burglary

English Law of Homicide

- ▣ Case study
- ▣ 32 male is seen to be punched by another male on street.
- ▣ Seen to fall backwards and strikes head on ground
- ▣ Whilst on ground second male runs across road a distance of 20 metres and kicks man lying on ground in side of head.

English Law of Homicide

- ❑ Man is taken to hospital fully conscious, where he is observed for head injury
- ❑ CT scans show characteristic frontal contrecoup contusions
- ❑ After 4 days he suddenly deteriorated and died
- ❑ At autopsy he had evidence of an occipital fracture extending up to the clinoid process
- ❑ Brain showed characteristic contrecoup contusions which were haemorrhagic

English Law of Homicide

- ❑ Two men charged with murder
- ❑ One pleaded guilty to manslaughter at the start of the trial, the other defendant offered affray as a plea
- ❑ Forensic Pathologist and neuropathologist for the Crown stated that the kick by the second defendant could have contributed to the death.
- ❑ Defence Pathologist argued that there was no evidence that the kick had contributed, however ugly it looked on CCTV

English Law of Homicide

- ❑ Crown argued murder on
- ❑ A) Kick contributed
- ❑ B) There was a joint enterprise by the two defendants to commit grievous bodily harm and thus have the mens rea for murder
- ❑ After Crown's medical evidence had been presented and cross-examined Crown dropped argument (a) but still argued (b)
- ❑ Both defendants were convicted of murder and appealed

English Law of Homicide

- At the Court of Appeal the Court ruled there was no evidence of a joint enterprise and substituted convictions for manslaughter and affray

Manslaughter and Natural Disease

- ▣ R v Dawson 1985
- ▣ A Petrol Station attendant collapsed from a heart attack during an armed robbery. There was no evidence that the defendant knew that the victim had a heart condition
- ▣ Court of Appeal quashed conviction for manslaughter
- ▣ Objective test - reasonable person would know that act likely to cause some harm. If a person has some special susceptibility, this cannot be taken into account.

Manslaughter and Natural Disease

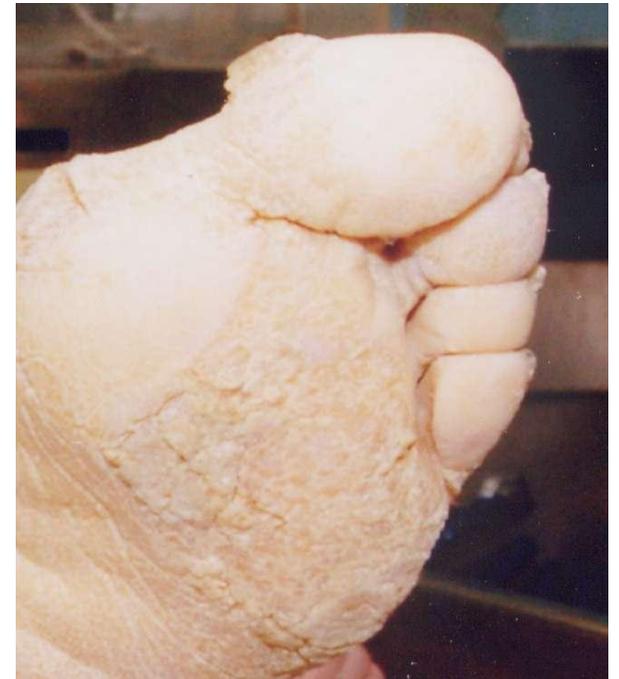
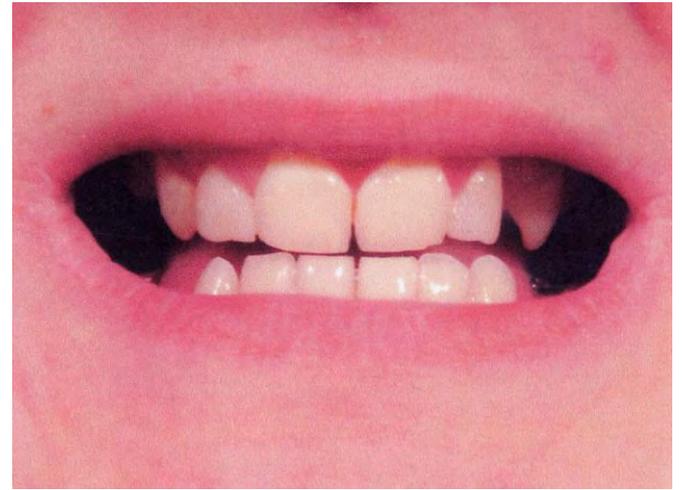
- ❑ R v Watson 1989
- ❑ A frail 87 year old man died 1 1/2 hours after a burglary - the unlawful act
- ❑ The defendant was convicted of manslaughter and his conviction upheld on appeal
- ❑ It was held that the risk of emotional disturbance produced by terror is not enough; but it would be if the risk of physical harm (e.g. a heart attack) from emotional disturbance was reasonably foreseeable.

Natural disease and homicide

- ▣ AW 15 year old girl. Out with other friends of a similar age.
- ▣ Incident took place with four other teenagers
- ▣ AW was struck, fell to the floor, got up and ran up hill approximately 90 metres, before collapsing and dying.

External Appearance

- ▣ Extensive skin changes:
 - Marked keratinisation of the soles of the feet and the palms.
 - Most marked on the feet with areas of clefts in the skin.
 - Thickened keratinised skin with brown discoloration over the trunk and limbs.
 - Finger nails artificial, long and undamaged.
- ▣ Own natural teeth but with some loss.
- ▣ Hair “woolly” .
- ▣ Hair in the eyebrows sparse.

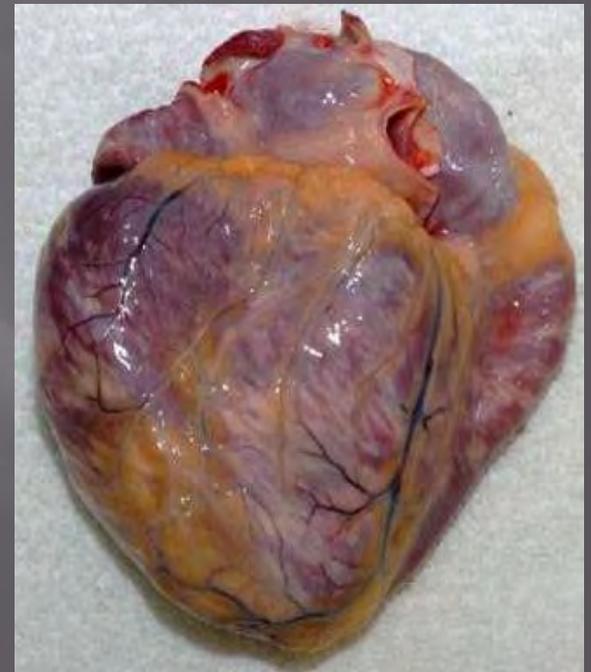


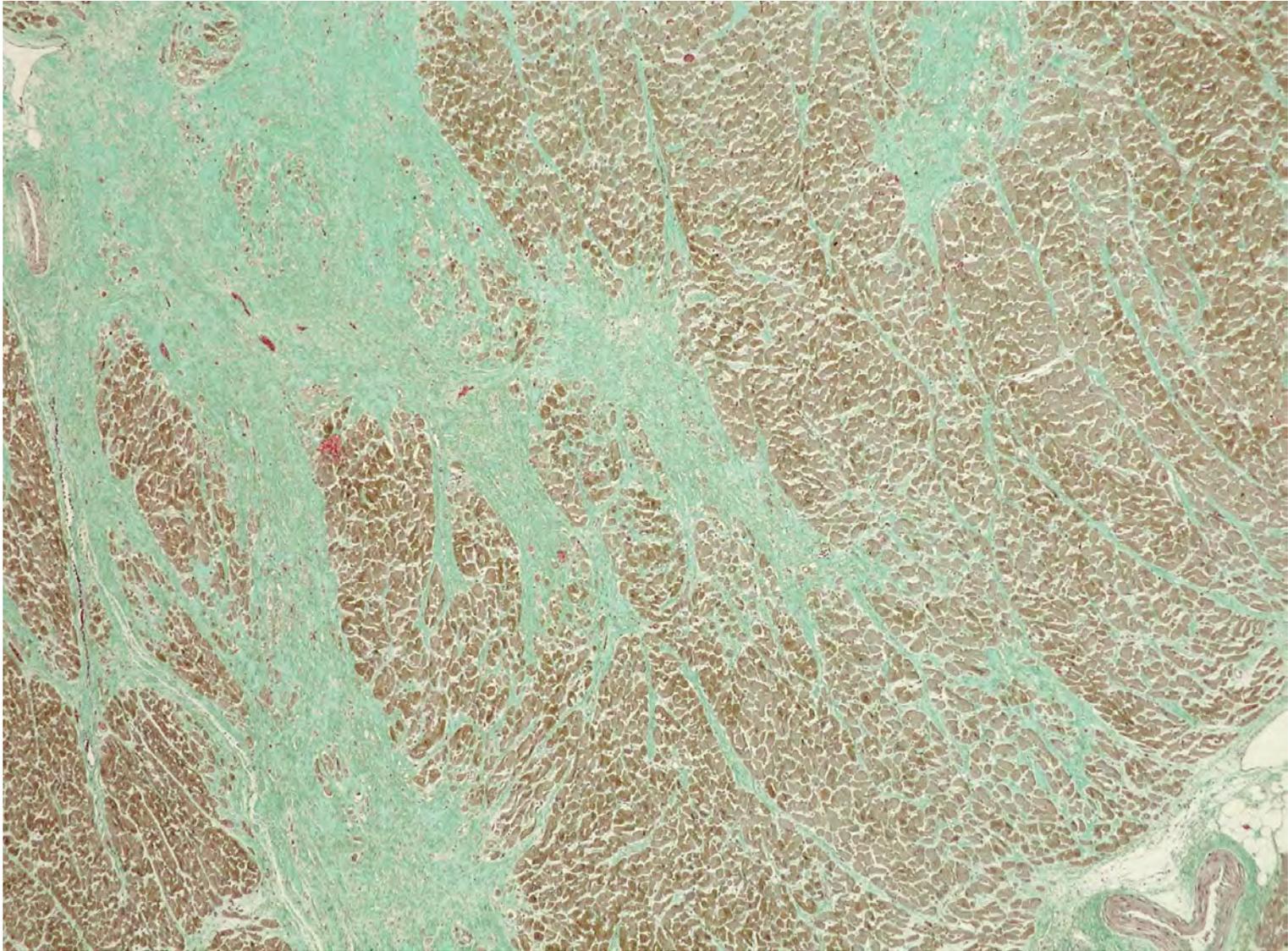
Injuries

- ▣ Injuries:
 - Very minor bruising to face
 - Bruising in the occipital region of the scalp.
 - No further injuries.

The Heart

- ▣ Heart grossly abnormal with extensive fibrosis of ventricles apparent externally.
- ▣ Sent for specialist examination.





What is going on?

- ▣ Hyperkeratosis of the Skin.
- ▣ “Woolly” Hair.
- ▣ Sparse Eyebrows.
- ▣ Missing Teeth (not trauma related).
- and
- ▣ Heart Disease.

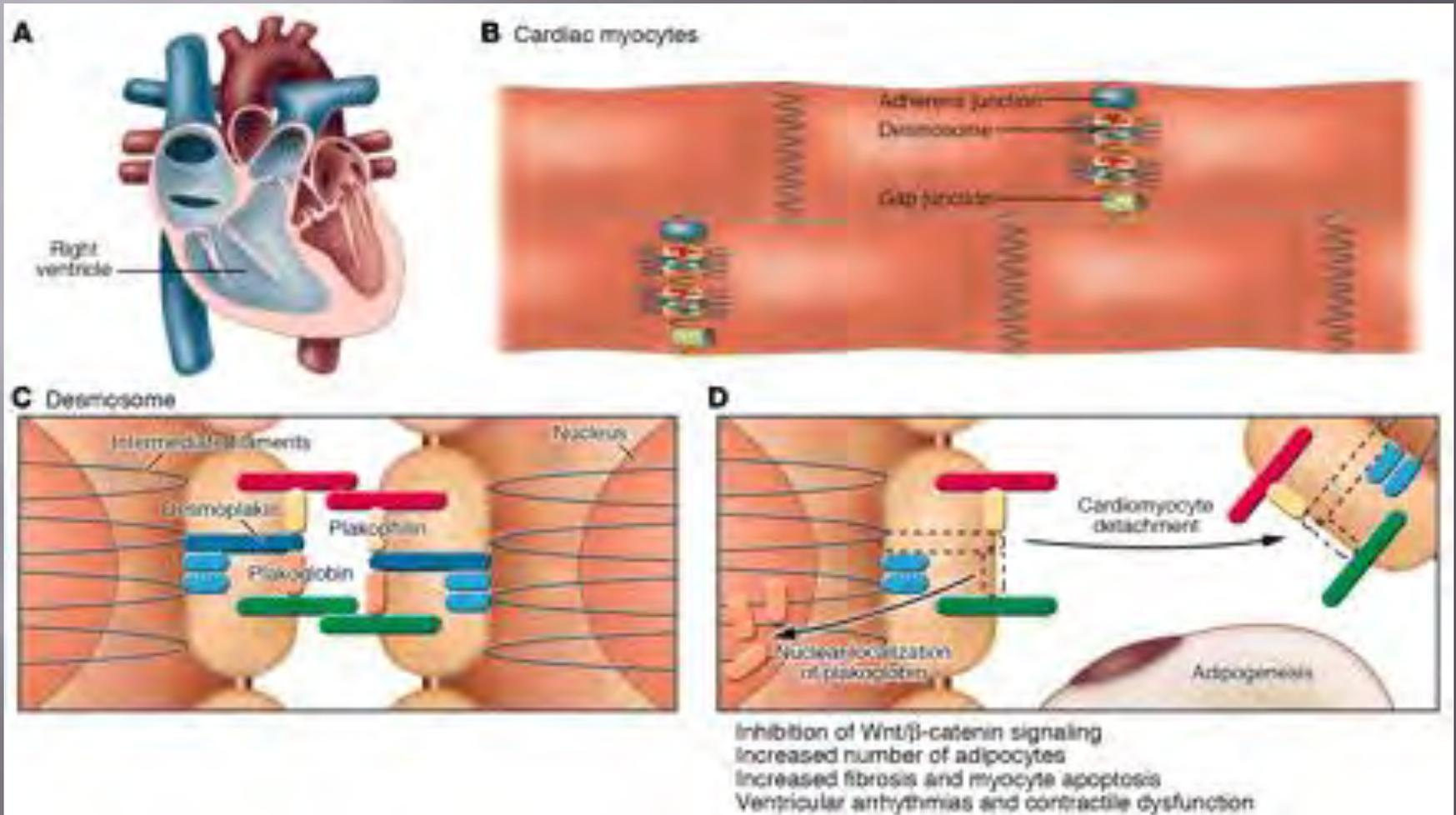
Palmoplantar Keratodermas (PPK)

- ❑ Broad heterogeneous group of conditions associated with hyperkeratosis of the palms and soles.
- ❑ Classification
 - mode of inheritance.
 - clinical features.
 - associated abnormalities.
- ❑ In the life, due to abnormalities of the teeth the condition had been called Papillon-Leferve syndrome (or PPK with periodontopathia). Although the diagnosis had not been confirmed/established.

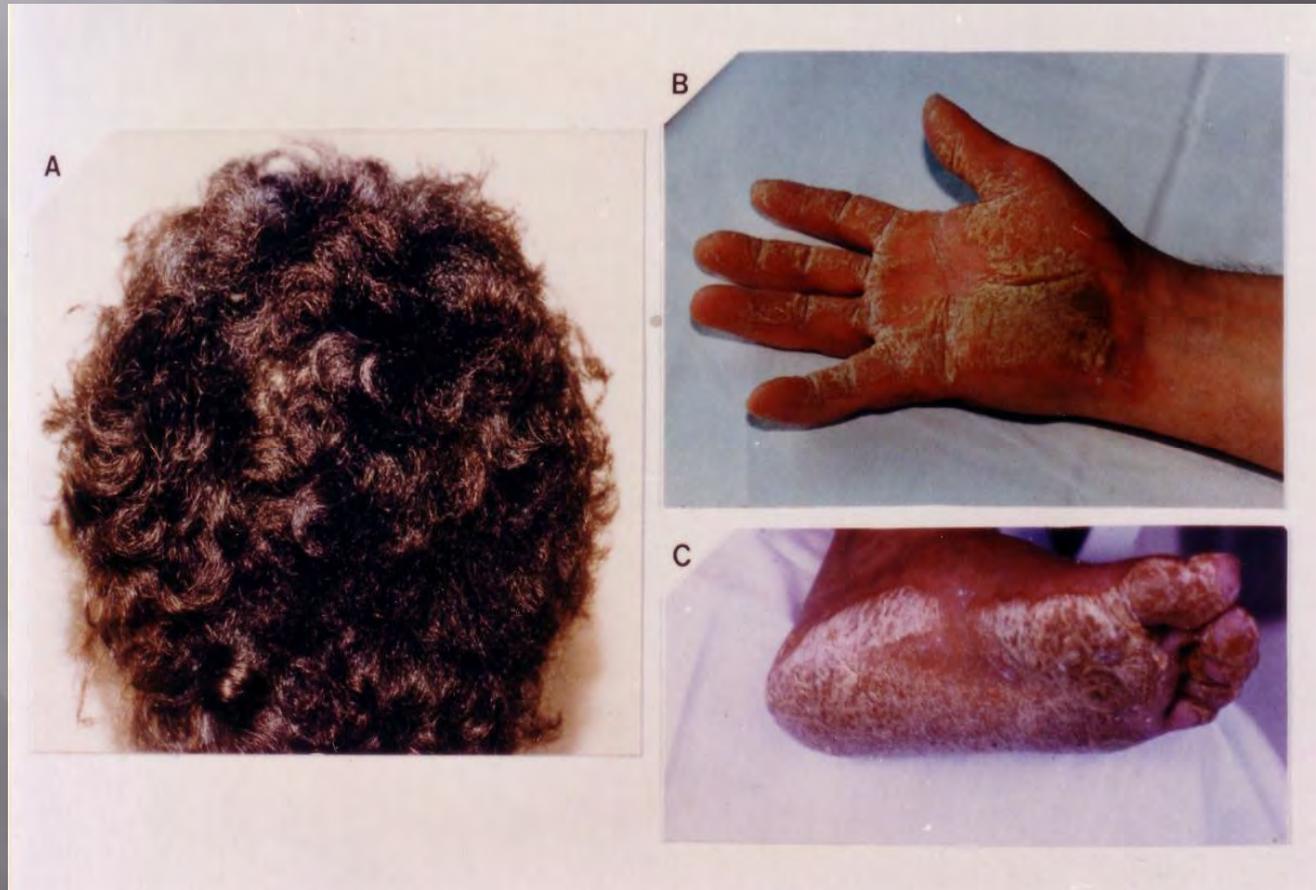
Palmoplantar Keratodermas

- ▣ No knowledge of cardiac disease in life.
 - But association between PPK and cardiac abnormalities.
- ▣ PPKs arise due to mutations in the desmosomal cell adhesion proteins, plakoglobin and desmoplakin, which are prominent in epidermal and cardiac tissue.

Plakoglobin and cardiac disease



Naxos Disease



Why die at this point at this time?

- ▣ During any stressful event the ‘Fight or Flight response’ occurs under the influence of the sympathetic nervous system.
 - Catecholamine released from adrenals into circulation.
 - Prepares body for vigorous activity
 - *Catecholamine release is typically highest not during activity but about three minutes after cessation*
 - Physiological effects include increased arterial pressure, smooth muscle contraction, blood diversion to muscle, increased cellular metabolism, increased blood glucose and alterations of blood clotting

Why die at this point at this time?

- ▣ Potassium blood concentrations also increase during exercise, but fall rapidly after cessation of the stressor.
 - The fall is such that profound hypokalaemia may develop for as long as 90 minutes.
 - Both extremes are arrhythmogenic, although the hyperkalaemia is neutralised by the catecholamine release.
 - As such, once again, vulnerability appears to arise particularly after cessation. This phenomenon is known as ‘post-exercise peril’ .

Interaction with Natural Disease

- ▣ ‘Fight or Flight response’ results in
 - increased rate and force of contraction of the heart,
 - increased conduction velocity
 - increased blood pressure
 - ischaemia may arise due smooth muscle contraction of the coronary arteries.
- ▣ In an already compromised heart, such as in this case or in an individual with coronary artery disease, these are arrhythmogenic.
- ▣ Strong evidence that exercise or emotional stress can induce arrhythmia and myocardial infarction is available in the literature.

R v Carey

- ▣ Four teenagers attacked four other teenage victims. One defendant punched and kicked one of the teenagers. A second defendant assaulted the deceased by pulling her hair back and punching her in the face. The third defendant assaulted another victim. A fourth defendant was subsequently acquitted of all charges. They then left. Aimee a girl aged 15, collapsed and died as she ran away.

R v Carey

- ▣ The prosecution relied on the affray as constituting the unlawful act and the judge accepted the prosecution submission that, when determining whether the affray had subjected the deceased to the threat of at least some physical harm, it was legitimate to aggregate the violence by the other defendants in order to decide whether the aggregated violence had been a cause of death.

R v Carey

- ▣ The Court of Appeal held that the charge of manslaughter should have been withdrawn from the jury. It was accepted that a person who inflicts a minor blow from which the victim dies is liable for manslaughter, but the court felt that to hold the defendants liable for the death of the deceased in this case would extend the law: it would come close to saying that if X commits an unlawful act but for which Y would not have died, X must necessarily be liable for the death of Y.

R v Carey

- ▣ What is required, said the court, is that X has committed an unlawful act that was dangerous in the sense that sober and reasonable persons would recognise that the act was such as to subject Y to the risk of physical harm that in turn caused Y's death. Whether an act is dangerous in the relevant sense depends upon what knowledge may be imputable to a reasonable person present at the scene. Knowledge of the victim's attributes may be relevant. Here, no reasonable person would have been aware of the victim's heart condition. This was said to distinguish the instant case from *Dawson* (1985) 81 Cr App R 50, or *Watson* [1989] 1 WLR 684 in which the victim's approximate age and frail state would have been obvious to any reasonable person.

R v Carey

- ▣ Nor was this a case in which the victim died in the course of fleeing from the defendants' attack or from a threat of further violence (contrast *Roberts* (1971) 56 Cr App R 95). The incident had finished and the defendants had headed off in the opposite direction. The evidence suggested that she was merely upset and trying to hurry home. The court held that in some circumstances affray may be a suitable unlawful act but it was not in this instance because a sober and reasonable person would not have appreciated that an apparently healthy person of 15 years would suffer shock as a result of it.

R v Carey

- ▣ The only dangerous act in the relevant sense was the assault by the second defendant. But the deceased's death was not caused by injuries that were a foreseeable result of the assault. Other participants would be guilty of manslaughter if they were liable for the assault as secondary parties but the acts of those who participated in the affray but were not party to the assault did not, in any relevant sense, cause the death.