



## ABRASIONS

An abrasion is a destruction of the skin which usually involves the superficial layers of the epidermis only.

Abrasions are caused by friction of the skin against some rough or sharp surface resulting in the scraping away of superficial portions of the epidermis. Abrasions often take the form of parallel furrows in the skin surface. These

furrows may be broad at one end and tail away in the opposite direction. This appearance is usually indicative of the direction in which the force was applied. When the furrows extend deeply enough into the skin to involve part of the corium there is slight capillary bleeding. When the exuded serum or blood coagulates on the surface, a scab is formed.

Abrasions are of medico-legal importance as they indicate that some force has been applied to the body. Under certain conditions, the characters of abrasions may suggest the nature, direction and cause of the force and, possibly, the purpose for which it was applied. Abrasions are frequently caused by blows from blunt instruments and from falls. Such abrasions are commonly found on the head and the face and over bony prominences. Abrasions, when caused by falls, are often contaminated with gravel. Abrasions are often accompanied by other injuries such as bruises, fractures or internal injuries.

When abrasions are caused by finger nails they may appear either as crescentic marks (when the nails have been dug into the skin) or as relatively broad parallel grooves which tail away at their ends (when the nails have scraped away the epidermis.) Abrasions caused by finger nails are commonly found on the front and sides of the neck in cases of throttling (p. 79) and on the front of the neck, the thighs, the vulva and the wrists in cases of rape (p. 309).\*

Abrasions may be produced after death when a body is dragged away from the scene of a crime. The distribution of such abrasions depends upon the position of the body while it is being dragged. If the body was dragged face downwards, linear abrasions may be found on the front of the face, trunk, thighs or legs. If there is doubt as to whether an abrasion is ante-mortem or post-mortem in origin, it is advisable to excise the abrasion and submit the tissue for histological examination. On microscopic examination, ante-mortem or post-mortem abrasions may show underlying bruising of the corium, but if the period of survival after the injury has been sufficiently long, evidence of tissue reaction may be found.

Ant erosions of the skin may resemble abrasions. The differentiation of abrasions from ant erosions is dealt with on page 41.

Abrasions heal rapidly, and provided there are no complications such as infection, they do not leave permanent scars.

After death abraded surfaces dry out and acquire a parchment-like appearance. Such abrasions have been mistaken for burns.

## BRUISES OR CONTUSIONS

Bruises, contusions or ecchymoses are wounds which are characterized by the effusion of blood into the tissue spaces. Bruises vary in size and shape. They are usually caused by blunt weapons but they can be produced in other ways, e.g. by the pressure of the fingers in throttling.

The extent and the degree of bruising depend upon the amount of force applied to the body, and upon other factors such as the structure and vascularity of the

\* The debris removed from under the finger-nails of an assailant may contain particles of dried human blood. If this blood belongs to a blood group different from that of the assailant, but the same as the victim, this fact may help in the identification of the assailant.

affected tissues. The thickness of the skin, the texture of the subcutaneous tissues, and the relationship of these structures to the deeper tissues vary in different parts of the body. Bruises occur more readily in lax tissues such as the eyelids,\* than in dense tissues such as the palms of the hands. Bruising is usually more extensive in fatty tissue, and obese persons tend to bruise more readily than thin subjects. Bruising is relatively more marked in tissues overlying bones than in tissues which are able to yield under pressure, such as the tissues of the abdominal wall. Constitutional factors may predispose towards extensive bruising. This predisposition has been specially noticed in many apparently healthy women. In persons with nutritional deficiencies such as scurvy (which can occur in chronic alcoholics), or in persons suffering from blood disorders such as haemophilia, essential thrombocytopenia or other forms of purpura, extensive bruises may be caused by slight injuries.

Because of all these factors, it is not possible to determine the amount of force used from the extent and the degree of bruising.

The shape and size of a bruise may bear no relationship to the shape or size of the weapon or object which caused the bruise e.g. when a bruise is caused by a long rigid weapon such as a stick, the edges of the bruise may be irregular, while the width of the bruise may be greater than the width of the stick because of the infiltration of blood into the surrounding tissues along the edges of the bruise. In certain circumstances, however, the external pattern of a bruise may correspond to the form of the object or weapon with which it was produced. This condition may be of medico-legal importance and was noted in two of our cases of murder. In the one instance the deceased received numerous blows on her head and face with the head of an axe. At autopsy, a rectangular bruise measuring  $1\frac{3}{8}$  ins. from above downwards was observed over the right eye and the right cheek. The bruise is shown in Fig. 11.1A. (Fig. 11.1B shows an extensive comminuted fracture of the skull underlying the zone of injury.) An axe was found in the possession of the accused when he was arrested. The width of the head of this axe corresponded closely to the width of the rectangular bruise. In the other instance the deceased was severely assaulted by her reputed husband. Numerous external injuries were found on her body (Figs. 11.2A and 11.2B). The pattern of one bruise on the right breast above and to the inner side of the nipple had an unusual appearance and its exact dimensions were noted. When the accused was arrested he was wearing a pair of riding boots, and the heel of one of these boots corresponded in form and dimensions to this bruise.

When a rigid weapon such as a stick strikes a curved surface of the body in a region where the soft tissues are particularly pliable, e.g. the buttocks, the tissues may be compressed under the force of the impact. In these circumstances the bruise is not confined to the maximum convexity of the affected part, but it may extend over the whole of the curved surface. A similar appearance may be produced when a plastic weapon, such as a strap, becomes wrapped around the body or the limbs.

\* In fractures of the anterior portion of the base of the skull blood may be extravasated into the eyelids. Eyelid contusion, therefore, does not necessarily indicate the direct application of force to that region.



FIG. 11.1A. Depressed marking over right eye and cheek produced by the head of an axe. (Murder).

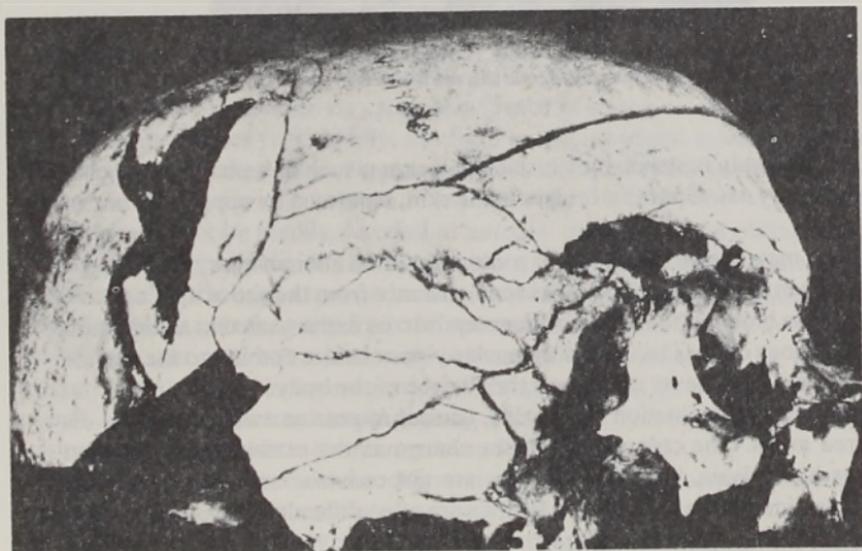


FIG. 11.1B. Same case as Fig. 11.1A. Extensive comminuted fracture of the skull.



FIG. 11.2A. Homicidal injuries. Ventral view. The bruise which corresponded to the heel of the assailant's boot is above and medial to the right nipple.

When the body is struck by a broad flat weapon such as a plank, the edges of the plank may cause parallel bruises in the skin, separated by apparently normal tissue.

Bruises may appear in the skin at a variable period after an injury to the deeper tissues. Such bruises may appear at some distance from the site of application of the force, as blood in the deeper tissues tends to be extravasated in all directions along the lines of the fascial and muscular planes before coming to the surface. Deep bruises may never appear on the surface of the body.

On external examination during life, bruises appear as swollen, tender, discoloured areas. The colours of bruises change as the extravasated blood undergoes haemolysis, but these changes are not constant and cannot be relied upon as an indication of their age. Bruises are often difficult to detect on external examination in dark-skinned persons.

Pulmonary and cardiac contusions and contusions of the abdominal and



FIG. 11.2B. Same case as Fig. 11.2A. Dorsal view.

pelvic viscera are described in Chapter 12. Internal contusions of this nature are not necessarily accompanied by external evidence of injury.

When a person dies very rapidly, e.g. from parasympathetic inhibition of the circulation (p. 130), the extent of bruising which accompanies a tissue injury may be very slight.

Bruises may not be readily detected at autopsy or they may be obscured by patches of post-mortem lividity or by the colour of the skin in dark-skinned persons. Bruises of the head can best be demonstrated by reflecting the scalp and making incisions into the scalp from the aponeurotic surface. Bruises in the cervical tissues can only be satisfactorily demonstrated by reflecting the various structures of the neck in layers as described at page 52. Bruises in the subcutaneous tissues of the trunk and limbs may be detected by making parallel strip incisions through the skin in the manner described at page 105.

Ante-mortem bruises must be differentiated from post-mortem dissection artefacts (p. 84). Bruises may become visible externally some hours or days after death. This is seen most commonly in putrefied bodies. The pressure of the gases of putrefaction may cause the extravasated blood to extend along the tissue

spaces and give rise to a false impression of the extent of ante-mortem bruising. Such apparent post-mortem extensions of bruises may also be due to the haemolysis of extravasated red blood cells and the diffusion of pigment into the surrounding tissues. A similar diffusion of haemoglobin may result from the haemolysis of intravascular collections of blood (p. 39). For this reason particular care should be exercised before regarding as a bruise an extravasation of blood which has only appeared after death.

It may be of medico-legal importance to distinguish between bruises and patches of post-mortem lividity. This subject has been dealt with on page

## INCISED WOUNDS

Incised wounds are caused by sharp weapons or objects such as knives, jagged portions of metal or pieces of broken glass. The general features of incised wounds are set out in Table 4 below.

An incised wound caused by a sharp cutting weapon is usually linear in shape but it may have a curved or V-shaped appearance if the direction of movement of the weapon is changed during the infliction of the wound. The shape of an incised

Table 4.  
*General Features of Incised Wounds, Lacerated Wounds and Punctured Wounds*

<i>Description of Wound</i>	<i>Incised</i>	<i>Lacerated</i>	<i>Punctured</i>
Manner of production	By sharp objects or weapons	By blunt objects or weapons	By pointed weapons which may be sharp or blunt
Shape	Linear or spindle-shaped	Varies; usually irregular	Linear or irregular, according to nature of weapon
Edges	Clean cut and everted	Ragged and often undermined	Varies according to nature of weapon, but edges often everted from withdrawal of weapon
Dimensions	Usually longer than deep, but often gaping	Depth varies, but hand-lens examination reveals bridges of tissue joining the edges	Depth greater than length and width
Haemorrhage from wound	Usually profuse, especially if vessels incompletely cut	Not pronounced	Varies, profuse if vessels are cut in depth of wound
Condition of skin surrounding wound edges	Bruising may or may not be present	Bruising usually present	Bruising rarely present

wound may depend upon the shape of the blade of a weapon, e.g. in one of our cases a curved incised wound of the front of the neck was caused by a curved pruning knife. Incised wounds caused by jagged portions of metal or pieces of broken glass may appear to be irregular in shape but the close examination of such wounds shows that the edges are characteristically clean-cut and everted.

As incised wounds usually gape, the breadth of the cutting edge of a sharp weapon cannot be determined from the width of the wound. In deep incised wounds, the degree of gaping is greater when the muscles are cut transversely than when they are cut in the longitudinal plane of their fibres. In a deep incised wound, blood vessels, nerves and tendons may be severed. Bleeding from an incised wound may be profuse, e.g. when a vessel is partially cut. Paralysis, deformity and loss of function may follow the cutting of nerves and tendons.

Infection of incised wounds is relatively uncommon and if the edges are approximated by surgical suture, an incised wound usually heals by first intention with minimal scar formation.

As there is a limited destruction of tissue, an uncomplicated incised wound is usually unaccompanied by traumatic shock, but shock may be a prominent feature if the wound extends into one of the body cavities and involves an internal organ.

A single movement of a sharp weapon over the skin surface usually produces a single incised wound. When the skin becomes folded under the cutting edge of the weapon a single movement of this nature may produce a series of incised wounds separated one from another by bridges of normal skin.

Incised wounds are commonly seen in cases of assault and homicide. Homicidal incised wounds are usually multiple and can occur in any region of the body. If, in a case of homicidal wounding, the victim tried to defend himself by warding off blows or by grasping the weapon, multiple incisions may be found on his forearms and in the palms of his hands.

Accidental incised wounds are seen in traffic injuries when they are usually caused by pieces of broken glass and involve exposed parts of the body such as the face and the hands. Fragments of glass may be found in such wounds and it is important to retain such fragments or any other foreign bodies which may be found in the wounds.

Suicidal incised wounds are commonly seen in the region of the wrists and the neck (p. 252). Incised wounds are sometimes self-inflicted for the purpose of bringing false charges against other persons. According to Smith<sup>3</sup> these fabricated wounds are usually superficial and they often consist of a series of parallel or crossing incisions. Although these injuries may be found in any region they are seen most commonly over the top of the head, the outer side of the left arm, the front of the left forearm, the front and outer side of the thighs, and the front of the abdomen and chest. Smith has stressed the need for an examination of the clothing in these cases as the fabricator seldom injures himself through his clothes.

Incised wounds may be produced after death. Haemorrhage from such post-mortem wounds and their differentiation from ante-mortem wounds is dealt with at pages 213–214.

## LACERATED WOUNDS

Lacerated wounds are wounds in which the tissues are torn as a result of the application of blunt force to the body. The force may be produced by some moving weapon or object or by a fall. Localized portions of tissue are displaced by the impact of the blunt force. This displacement sets up traction forces and tearing or rupture of the tissues results (p. 190). Displacement of tissues is prone to occur when soft tissues are crushed against bone. Bruises are produced by the same mechanism as lacerated wounds, and these two types of tissue injury are often associated. Both types of injury are commonly complicated by fractures and dislocations and by injuries to internal viscera.

The general features of lacerated wounds are set out in Table 4 (p. 200).

An external lacerated wound caused by the splitting of soft tissues against underlying bone (in regions such as the head, the face and the shins) is often linear in shape and may resemble an incised wound. A hand-lens examination, however, will show that the edges of the wounds are irregular and often bruised while there is an incomplete separation of the tissues between the edges of the wound. If hair-bulbs are present in the area involved, they will be seen to be crushed instead of cut. The shape and size of a lacerated wound usually bears no relationship to the shape or size of the weapon or object which produced it. A lacerated wound, e.g. from a single blow with a rod-shaped instrument, may have a Y-shaped termination.

The depth of a lacerated wound is variable and a hand-lens examination may show intact vessels, nerves or tendons stretching across the wound.

A single blow with a blunt weapon may produce more than one lacerated wound, e.g. a single blow over the side of the head may produce lacerated wounds over the lower jaw, the ear and the parietal prominence.

As the blood vessels are usually crushed, external haemorrhage from lacerated wounds is not pronounced, but internal haemorrhage from ruptured viscera may be severe and lead to death. The clinical manifestations of internal haemorrhage may be delayed for several hours (see p. 270). Lacerated wounds are often contaminated with particles of sand and gravel and infection of such wounds is relatively common (see p. 207). The healing of a lacerated wound usually results in well-marked scar formation.

Lacerated wounds of the skin are seen most frequently in cases of assault and murder and in traffic injuries and other accidents. Self-inflicted lacerated wounds are uncommon. A combination of incised and lacerated wounds may be seen in cases of assault when a bottle has been used by the assailant.

In certain circumstances, even though the skin may not be damaged by a blunt force, widespread lacerations of the underlying soft tissues and viscera may occur.

Lacerations of internal viscera may be caused by the direct injury of the viscera by fragments of fractured bone; by the development of traction strains or shear strains in the viscera; by the stretching of visceral attachments; and by hydrostatic forces. These injuries are dealt with in Chapter 12. Lacerated wounds may be produced after death. Such wounds are commonly caused by animals, and their differentiation from ante-mortem wounds is dealt with at page 211.

## PUNCTURED WOUNDS

Punctured wounds are 'stab' wounds caused by long narrow instruments with blunt or pointed ends. Punctured wounds are described as 'penetrating' when they pierce deeply into tissues and as 'perforating' when they transfix tissues and cause exit wounds. Glaister<sup>4</sup> has suggested that the terms 'penetrating-incised' or 'perforating-lacerated', etc., should be used in the description of 'stab' wounds so as to indicate the nature of the weapon which caused them.

The general features of punctured wounds are set out in Table 4 (p. 200). Bullet wounds are described in Chapter 13.

The shape and dimensions of a pointed weapon cannot be determined from the shape and dimensions of the external opening of a punctured wound. When a sharp weapon such as a knife has been used, the external wound almost invariably takes the form of a slit having two pointed extremities. The mechanism whereby such a wound is produced has been described in detail by Gross.<sup>5</sup> Gross states that

... when the point of a knife penetrates into the body to a depth of half an inch more or less, it forms at first a wound with a sharp or pointed angle at each end; as the knife proceeds farther in, the end in contact with the cutting side of the knife naturally remains sharp and pointed; but the other end which is in contact with the back of the knife remains so also. This is because the back of the knife does not give its shape to the skin, but only causes further separation, so that the skin continues to be torn in the original direction and still forms a sharp and pointed angle. . . . When a wound has each end sharp and pointed, it must not be concluded that the wound has been inflicted by a dagger or other double-edged instrument; more frequently the wound has been caused by a knife with a round or square back.

When a knife is twisted as it is withdrawn from the tissues, the external wound may have a cruciate appearance.

An external wound caused by a rounded sharp weapon such as a skewer is not necessarily circular in shape as the skin may be split during the process of penetration. The external opening of a punctured wound may have a triangular or cruciate shape if it is caused by a weapon such as a file or a bayonet, or by a square-sectioned instrument such as a spike.

The dimensions of the external opening of a punctured wound may be smaller than the diameter or transverse dimensions of the weapon, as the elastic skin is often stretched during the process of penetration. On the other hand, the opening may be larger in cases where the weapon is withdrawn obliquely after penetration.

The depth of a punctured wound may be greater than the total length of the penetrating object or weapon because the tissues deep to the skin are often compressed during the process of penetration.

A single wound track is usually found in relation to a single external opening in a punctured wound. In certain cases, however, where the weapon is partially withdrawn and then reinserted in another direction, two or more tracks may be found in relation to a single external opening.

External haemorrhage from punctured wounds is usually limited in amount but serious internal haemorrhage may result from penetrating wounds of the thorax and abdomen. The clinical signs of such internal haemorrhage may be delayed (p. 270).

When a weapon such as a knife or a dagger is thrust into the tissues with considerable force the skin surrounding the wound may be bruised by the haft of the weapon.

As a weapon such as a knife or a dagger is usually held with the point downward, most 'stab' wounds are directed downwards through the tissues of the body. When such a weapon is held with the point upward (in the so-called 'continental' manner), the wound is directed upwards through the tissues of the body. These factors should be borne in mind when an attempt is made to determine the positions of an assailant and his victim at the time of an assault.

Punctured wounds occur most commonly in cases of assault and homicide, but they are also seen in traffic injuries and accidental falls on projecting objects. Self-inflicted punctured wounds are uncommon.

Penetrating wounds of the viscera are dealt with in Chapter 12.