

# Blunt injuries

Most of the injuries a doctor encounters in his practice are caused by blunt force trauma in domestic and work accidents, traffic accidents, sports, etc. They are usually caused by various objects or by force applied over a large area in falls or in being run over, buried, etc. Depending on the intensity of the violence inflicted, bruising, abrasions, blood spurts, lacerations, injuries to internal organs and blood vessels, fractures, crushing and separation of parts of the body may occur.

## Classification

- Contusions (contusio)
- Abrasions (excoriationes)
- Blood discharges (haematoma)
- **Laceration of bruised wounds (*vulnera contusolacera*)**

## Contusions (contusio)

A contusion is caused by the action of a blunt object of lesser intensity. It is manifested by a slightly raised reddening conditioned by dilation of skin vessels and swelling. It soon disappears, sometimes in a few hours. Bruising occurs when a blow is struck, e.g. by an open hand or fist, by a kick, by a bite. Two parallel, closely running stripes of redness occur after a blow with a long, narrow object (stick, whip, belt).

## Abrasions (excoriationes)

Abrasions (excoriationes) are caused by a blunt object applied obliquely or tangentially to the surface of the body. The direction of the abrasion is often discernible by the silk-paper like appearance of the upper layers of the skin. If the damage is superficial and only a few layers of skin are abraded, the abrasion is initially inconspicuous, slightly reddened and not bleeding. In a living person, the serum comes out, and in a few hours the abrasion is covered with a brown scab, which separates in a few days. In the next few days the skin in these places is slightly sunken and smooth. If deeper damage to the skin occurs, a punctate or diffuse haemorrhage occurs from the injured corium vessels. A reddish-brown scab forms and healing takes longer. The scab detaches in about a week. A whitish spot remains in its centre, which disappears within three weeks. The wound heals without consequence if there is no infection. In deeper abrasions, if they have been contaminated by dust and foreign bodies, these may heal and pigmentation of the skin occurs. If the person dies shortly after the abrasion, a scab will not form. The abrasions, on the other hand, dry and have a parchment-like reddish-brown appearance. Abrasions produced after death also dry and are parchment-like but yellow or yellow-brown in colour. Post-mortem abrasions on the lowest parts of the body do not dry, may also be red in colour and have the appearance of abrasions produced alive. On the chest, brownish-red parchment-like abrasions often occur after indirect cardiac massage and circular abrasions after defibrillator treatment.

From a forensic medical point of view, the shape and arrangement of the abrasions and the distinction of whether they occurred alive or after death are important. Striated abrasions are caused by a narrow object or the edge of an object. Flat abrasions are caused by a flat object. When the body is dragged, thrown or dropped on an inclined surface, superficial abrasions are produced in which striated or linear abrasions are indicated in the direction of movement of the body or object. Abrasions arising from a nail are linear or arcuate. Even intravital abrasions which are entirely superficial may not be apparent immediately after their formation and may not become apparent until several hours later by reddish-brown colouration due to drying. When driven over or run over, they often match the appearance of the tyre pattern. In addition to the reddish-brown colour, the finding of subcutaneous blood pools at the site of the abrasion and histological examination with evidence of incipient inflammatory changes in abrasions and wounds at least 4-6 hours old may help to determine intravital origin. The earliest vital changes, which include an increase in free histamine and serotonin in just a few minutes, can be demonstrated by chemical examination. Histochemical examination further demonstrates increased activity of certain enzymes (mainly aminopeptidase and acid phosphatase) in the peripheral zone of the abrasion or wound when surviving 2-4 hours after its onset. In addition to the demonstration of intravital origin, these methods can also contribute to the determination of the age of the injury.

## Blood discharges (haematoma)

Haematomas are caused when blood vessels rupture. They can arise in the skin, subcutaneous tissue and deeper soft tissues. They may be visible under the skin immediately after the injury or over several hours to several days. Sometimes they may not appear at all. Their extent depends on the intensity of the violence inflicted, the body landscape and its blood supply, the size and type of injured vessel and the health of the injured person (blood clotting disorders, high blood pressure). Arterial haemorrhage is larger than venous haemorrhage; likewise, in a sparse connective tissue, a sprain will spread more easily. Above the bone, the abscess spreads over the area.

The shape of the blood spurt cannot be used to judge the shape and size of the instrument that caused it. Sometimes, however, it is possible to infer the instrument. Particularly characteristic are the double banded haemorrhages with a streak of faded skin in the middle between them after a blow with a stick or blows with other

oblong objects of circular diameter. At the point of impact, the tissue is compressed and the pressure wave suddenly pushes the blood to both sides, causing the blood vessels to rupture with the blood exiting into the surrounding area. A pattern of textiles may also be visible in the form of blood spurts. A great pressure of a blunt object catching the skin and displacing it against the deeper layers results in its pocket-like detachment from the underlying skin without breaking it, and a *décollement* is produced. The resulting subcutaneous pocket is sometimes filled with a considerable amount of blood and bruised adipose tissue. This occurs in road accidents when a part of the body is struck or dragged, most often when the violence is inflicted in areas with more subcutaneous fat, such as the thighs or buttocks. Blood effusions in the soft skull caps at the site of blunt violence should be distinguished from blood effusions between the skull bones and the galea aponeurotica, which usually spread along the fractured skull bone and do not coincide with the site of violence. In the sparse connective tissue resulting from the descent of the effusion to lower sites, the effusion may occur at a more distant site from the site of violence. When the trunk is crushed, blood spurts are produced in the conjunctivae of the eyes and in the temporal muscles as a result of considerable blood stasis.

A fresh blood eruption appears as a blue to blue-red swelling on the skin. The swelling is particularly strong in areas of sparse connective tissue on the scrotum, on the external genitalia of women and on the eyelids. The change in the colour of the swelling with age depends also on its extent. In small hemorrhages and at the margin of large ones, a brownish-purple to greenish colour occurs within a few days and after a week a yellowish colour. Smaller hemorrhages are absorbed in about a week, larger ones in 2-3 weeks. The absorption of the spur also depends on the age and health of the injured person, so great caution is needed in estimating the age of the spur.

Histologically, after a few hours, leukostasis and leukocytes are visible at the edge of the sprain, which can appear even in 10 minutes. After 4-6 hours, leukocytic infiltration of the tissue begins, which after 1-2 days is very strongly marked at the edge of the sprain. After 2-3 days histiocytes are detected, in about 4 days to a week hemosiderin is detected, in 5-6 days new capillary formation and collagen fiber formation begins. In about 10 days, hematoidin appears.

Bloody effusions are a sign of a vital reaction, but they should be evaluated very carefully. They can occur soon after death, e.g. in the soft skull caps after blunt force trauma. Particular caution is needed when assessing blood spurts at the site of post-mortem stains. The presence of fibrin is not a sure sign of intravital origin, since blood clotting occurs even in the first hours after death.

The extent of the blood spurting during repeated blunt force of considerable intensity, e.g. during beating, may reach such a degree that the victim is at risk of subcutaneous haemorrhage and shock. The course may also be adversely affected by fat embolism.

## Vulnera contusolacera

Vulnera contusolacera are caused by overcoming the elasticity of the skin by pressure and pulling of a blunt instrument on the surface of the body. The wound may be rectilinear, arcuate, serrated, fractured, multi-angled, star-shaped, etc. It may also be lobed when the skin is detached between the angles. The edges are usually uneven, the angles obtuse, and there, as on the uneven base, run transverse bands of intact subcutaneous connective tissue called connective tissue bridges. If the blunt instrument has been applied where the bone is immediately under the skin, the edges of the wound may be smooth and resemble a cut. If no ligamentous bridges are visible in the wound, it can be distinguished from a cut or incision wound by the abrasion in the immediate vicinity of the wound and the subcutaneous haemorrhage. When a blunt object is applied obliquely to the body, the tension and displacement of the skin may cause lacerations at a more distant location from the site of the violence. When the instrument is applied obliquely, the skin at the site of violence may be torn away from the underlying skin. If a V-shaped flap is formed, the tip of the flap shall be directed against the direction of the striking instrument. The wounds bleed little and heal poorly without surgical treatment; they may necrotise and infectious complications can occur easily.

From a forensic point of view, it is important that particles of the object with which the wound was inflicted are often found in the wound. For example, when a pedestrian is struck by a vehicle, small fragments of paint or glass may remain in the wound, when a metal object strikes a pedestrian, small fragments of metal, etc. The discovery of these foreign particles may contribute to the clarification of the accident and to the identification of the instrument. In these cases, the excised material should be submitted for further expertise during surgical wound revision.

Accidental blunt injuries are the most common and occur at work, in sports, in falls, in traffic accidents, etc.

Suicides are most often carried out by jumping from heights and being run over by trains. The action of a blunt object against one's own body does not cause such serious injuries that would lead to death.

The murders are frequent and consist mainly of repeated, numerous blows with a blunt object to various parts of the body, especially the head. Signs of self-defence (subcutaneous blood smears, abrasions, lacerations) are mainly on the upper limbs, on the backs of the hands, etc.

The cause of death in blunt trauma is usually brain injury, intracranial haemorrhage, injury to the thoracic, abdominal and pelvic organs, exsanguination or bleeding of body cavities and shock. In addition, complications of these injuries such as fat embolism, pneumonia, pressure ulcers, sepsis and thrombotic pulmonary embolism are common.

## Links

## Related articles

- Traumatic spinal cord syndromes
- Injury
- Subarachnoid haemorrhage
- Shock classification
- Blood Capillaries; their function and management
- Skin
- Examination of skin and skin appendages

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