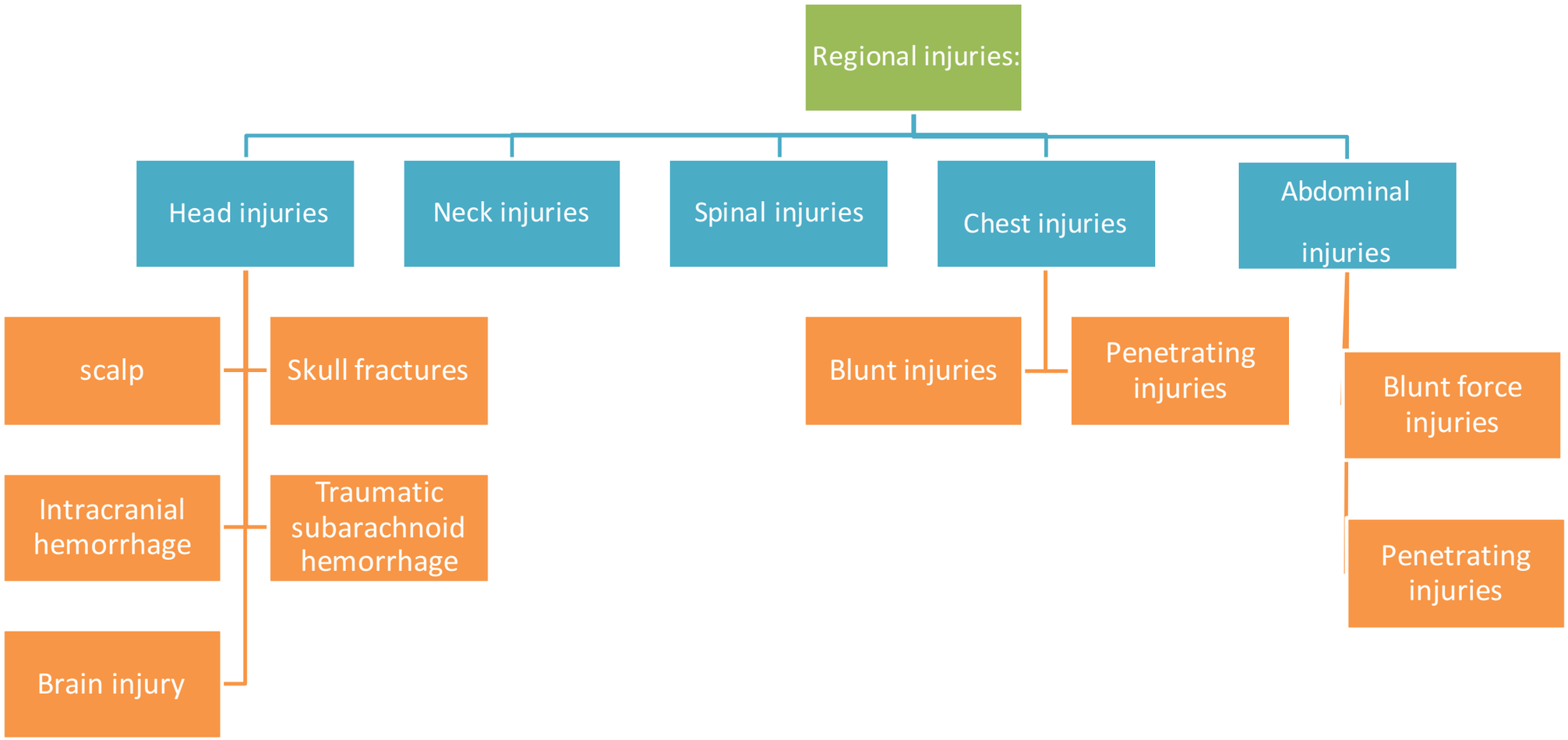
CHAPTER 9: REGIONAL INJURIES

Introduction:

Specific regions of the body may be particularly susceptible to types of trauma that may not cause serious or fatal injury elsewhere. A good example of this may the single stab wound. If this penetrates the limbs then a serious or fatal outcome is unlikely, unless a large artery is injured. If a single stab wound penetrates the heart or the abdominal aorta a fatal outcome is much more likely. Consideration of patterns of injuries according to the body region, and the potential complications of those injuries, is therefore an important component in both the clinical and pathological evaluation of trauma.



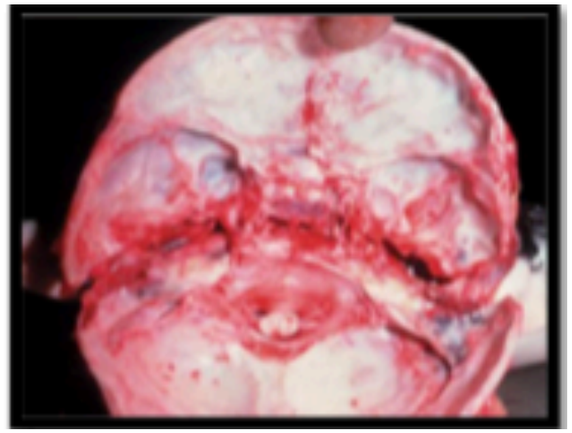
1- Head Injuries :

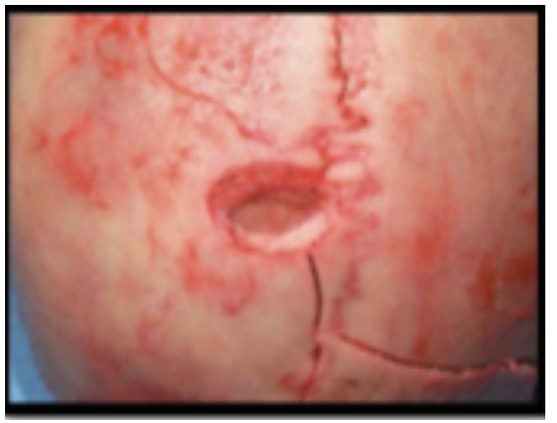
- Any trauma to the head or face that has the potential for damaging the brain can have devastating consequences.
- Normally the brain is protected within the bony skull, but it is not well restrained within this compartment and injuries to the brain result from differences between the motion of the solid skull and the relatively ‘fluid’ brain.
- There are three main components of the head: the scalp, the skull and the brain.
- The clinical significance of any space-occupying lesion (e.g. intracranial hemorrhage) within the cranial cavity is the effect that the raised intracranial pressure has on brain structure and function.

Scalp:

- Bruises of the scalp are associated with prominent edema.
- The easiest way to detect scalp injuries is by finger palpation, but shaving is often required.
- Lacerations of the scalp can usually be distinguished from incised wounds, its relative ‘thinness’ and tethering to the skull, contributes to the appearance of an incised wound following blunt impact.
- Scalp abrasions, bruises or lacerations represent contact injuries, and their presence will assist in the identification of the point of contact/impact. Bruises, however, may evolve, and ‘move’ in tissues planes.

Skull fractures:



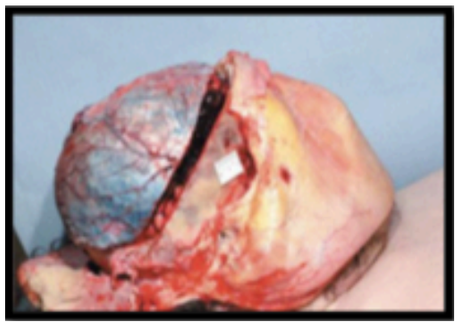


- **The complexity of the skull structure means that mechanisms of skull fracture can be extremely complex as a result of both direct force (e.g.** direct impact to the parietal bone causing a linear fracture**) and indirect force (e.g.** an orbital blowout fracture caused by impact to the eyeball**).**
- **The site of fracture therefore represents that point at which the delivered energy has exceeded the capability of the skull to distort, which is not necessarily at the site of impact, the skull's capability to distort before fracturing varies with age, and an infant skull may permit significant distortion following impact without fracturing.**
- **Fatal brain injury can occur in the absence of externally visible scalp injury, or skull fracture and, conversely, scalp injury overlying skull fracture may be associated with minimal (or no recognizable) brain injury or neurological deficit.**
- **A direct blow to the nose can cause blunt force injuries to the nose itself, but may also cause bilateral periorbital bruising.**
- **Blows to the top of the head commonly result in long, linear fractures that pass down the parietal bones.**
- **If the vault fractures extend through the skull base from both sides, they may meet in the midline, at the pituitary fossa, and produce a complete fracture across the skull base: this is known as a hinge fracture.**

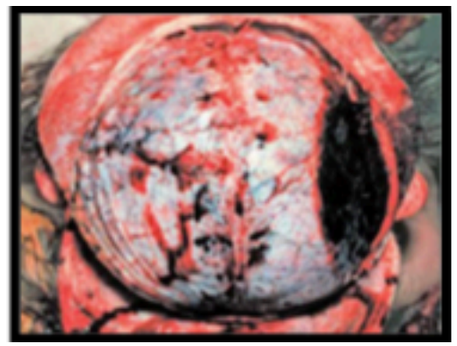
Intracranial hemorrhage:

- The anatomy of the blood vessels within the skull has a major influence on the type of bleeding.
- The meningeal arteries are generally protected from the shearing effect of sudden movement but are damaged by fracture lines that cross their course.
- The connecting veins are at particular risk of 'shearing' injury when there is differential movement between the brain and the skull.
- The cerebral arteries and veins, lies beneath the arachnoid membrane and is generally protected from all but penetrating injuries.
- Extradural hemorrhage is associated with damage to the meningeal artery, particularly the middle meningeal artery.

Extradural hemorrhages are ones that in the clinical setting may present with head trauma and then a 'lucid period' of half an hour or more, before rapid deterioration. Rarely, can develop as a result of venous bleeding.



- **Subdural hemorrhage** is associated with damage to the communicating veins, the venous damage is not necessarily associated with fractures of the skull.
- Recent subdural hemorrhages are dark red in color and shiny
- Microscopically, hemosiderin can be identified with Perl's stain
- Chronic subdural haematomas are seen in those prone to frequent falls, and elderly, whose cerebral atrophy allows space for the formation of the haematoma without apparent significant clinical effect.



Traumatic subarachnoid hemorrhage:

- Small areas of subarachnoid hemorrhage are common where there has been direct trauma to the brain, either from an intrusive injury, or from movement of the brain against the inner surface of the skull.
- Large basal subarachnoid hemorrhages can be of traumatic origin and follow blows or kicks to the neck.
- The vertebral arteries are confined within foraminae in the lateral margins of the upper six cervical vertebrae and are susceptible to trauma either with or without fracture of the foramina.
- Most basal subarachnoid hemorrhages are, however, non- traumatic in origin and arise from the spontaneous rupture of a berry aneurysm of one of the arteries in the circle of Willis.

Brain injury:

- Injuries that have resulted in skull fractures or intracranial hemorrhage are clear macroscopic markers of significant force having been applied to the head and therefore to the brain.
- Whatever the precise cause of the trauma, the effects on the brain, as a whole, are the same and, as a consequence of the body's response to primary traumatic brain injury, cerebral oedema develops (i.e. secondary brain injury).
- Direct injuries to the brain from depressed or comminuted skull fractures result in areas of bruising and laceration of the cortex.
- Penetrating injuries from gunshots or from stab wounds can cause injuries deep within the white matter, and the tissue adjacent to the wound tracks will often be contused and lacerated.

2- Neck injuries:

- **Its relevance in forensic medicine results from :**
  1- The presence of a large number of vital structures.
  2- It is particularly prone to injury.

- **The forensic post-mortem examination of the nick is done by: a layered, dissection of the anterior (and often posterior) neck structures.**
- **In a penetrating trauma – sharp force or ballistic – to the neck: Of particular forensic significance in incised wounds to the neck is the pattern of injury:**
- **1- Arterial injury: suspicious death.**
- **2- venous injury: possibility caused by cardiac air embolism.**

3- Spinal injuries :

- **The spine is very commonly injured in:**

1- major trauma

2- More subtle injury, e.g. disruption of the atlanto-occipital joint which can be the cause of damage to the upper cervical spine.

- **The spinal damage will depend upon:**

1- Anatomical site

2- Mechanism of injury.

3- The type of injury: depends upon degree of force and the angle at which the spine is struck.

- **Structures in the spinal cord that can be affected:**

The discs, the vertebral bodies, the neural, arches and the transverse processes.

- **Whiplash injuries in road traffic fatalities are associated with hyperextension of the neck.**
- **Hyperflexion injuries can be caused if heavy weights are dropped onto the back of a crouching individual.**

Cont'd: Spinal injuries :

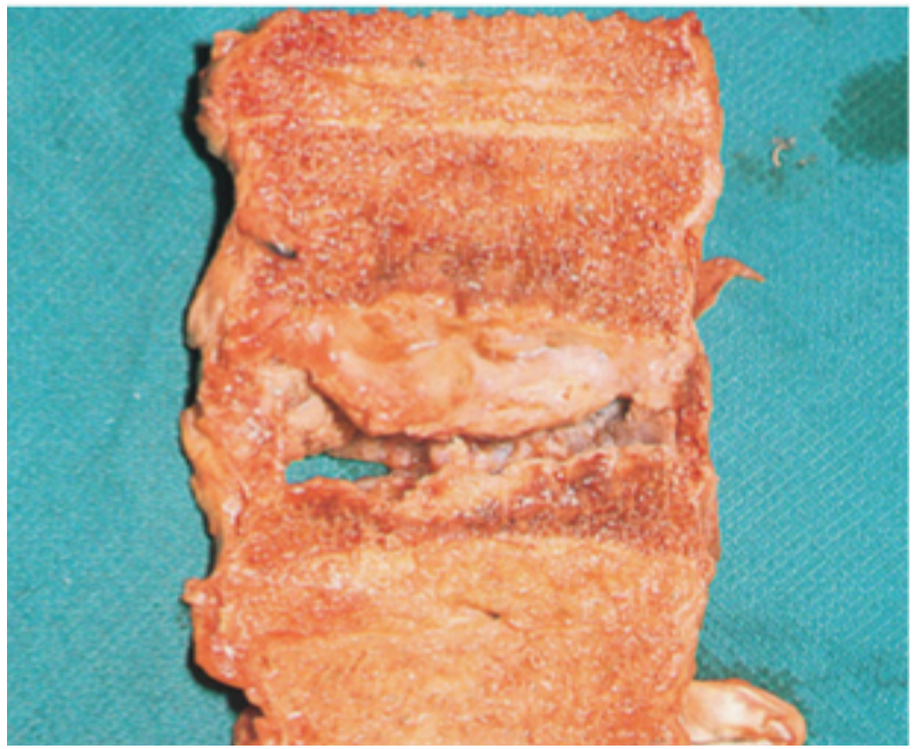
Forceful extension of the spine:

- **Rare, causes cervical injuries and associated with judicial hanging.**
- **In this kind of injuries there is:**

1- Long drop before the sudden arrest

2- Forceful extension of the neck.

Forceful flexion of the spine: Will commonly lead to the 'wedge' fracture or compression of the anterior aspect of a vertebral body.



4- Chest injuries :

Blunt injuries:

- **Results in fractures of the ribs:**

1- Few: unlikely to cause effects

2- Numerous: functional integrity of the chest wall may be compromised.

" Multiple rib fractures may result in the so-called 'flail' chest.

3- Trauma that has fractured left sided 10th, 11th and 12th ribs may be substantial enough to cause injury to the underlying spleen.

- **Rib fractures may have other more serious consequences based on the direction of the sharp end:**

1- Inward: pneumothorax, hemopneumothorax

2- Outward: Pneumothoraces.

- **Rib fractures in children in forensic medicine they can be a marker for non-accidental injury.**
- **Rib (and sternal) fractures in adults are frequently identified at post-mortem examination following cardiopulmonary resuscitation (CPR).**

QUESTION: when a microscopic examination of rib fractures identified at post-mortem examination is required ??

ANSWER: If there is evidence of 'healing changes'.

CONT'D: Chest injuries

Penetrating injuries:

- **The effect of the penetration will depend mainly upon which organ(s) or vessel(s) are injured.**
- **It can lead to the development of pneumothorax, haemothorax or a combination (haemo-pneumothorax).**
- **At post-mortem examination: it is not unusual to find several liters of blood within the chest cavity, because hemorrhage from penetrating injuries to the chest may remain concealed with little external evidence of bleeding.**

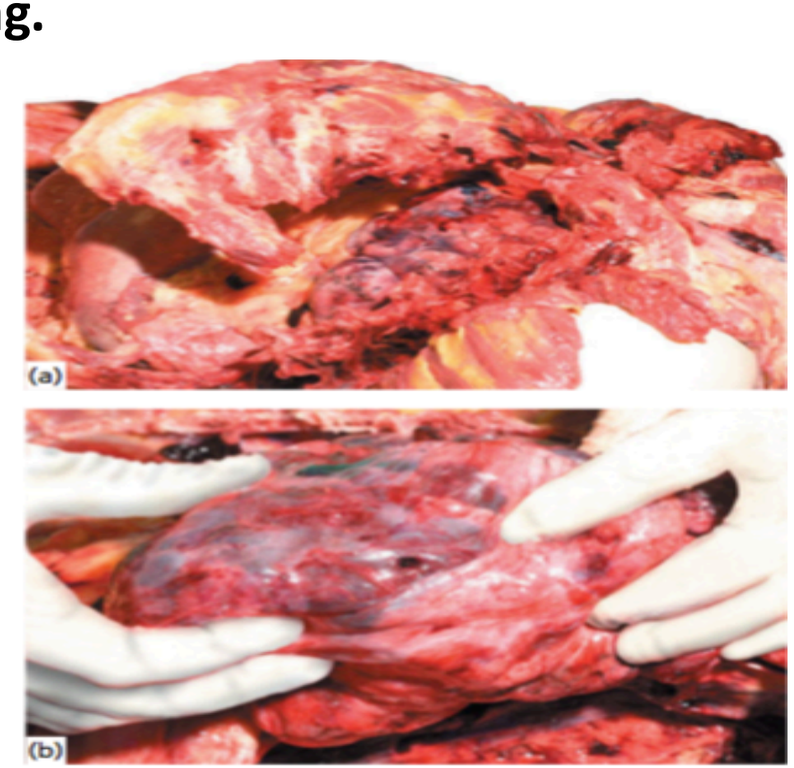


Figure 9.14 Multiple rib fractures **(a)** following a road traffic collision. There were many 'flail' segments and fractured rib ends pierced the underlying lung **(b)**.

4- Abdominal injuries :

Blunt force injuries:

- **Blunt force injuries especially in the anterior/posterior direction can cause compression of the organs lying in the midline against the vertebral column, which in order causes injury to intra-abdominal organs, including:**
- **1- Bruising (or transection) of the duodenum or jejunum.**
- **2- Pancreas.**
  3- Liver.
- **4- Disruption of omentum and mesentery.**
- **The forces required to cause these injuries are severe and they are commonly encountered in road traffic collisions.**
- **Kicks and stamps are commonly the cause of major trauma.**
- **The kidneys and the spleen are susceptible to direct trauma + to rotational forces**
- **Causes avulsion from their vascular pedicles.**
- **Spleen is sometimes associated with delayed rupture leading to hemorrhage and**
- **possibly death some hours or even days after the injury.**
- **Pancreatic trauma may lead to the development of a pseudocyst, with little or no short-term or long-term sequelae.**
- **In children: Abdominal injuries may have the same causes, but the force required to cause injury is reduced, also a slower compressive forces associated with squeezing of the abdomen during abuse may also result in those kind injuries.**
- **Intraabdominal injuries could be caused by CPR but rarely.**

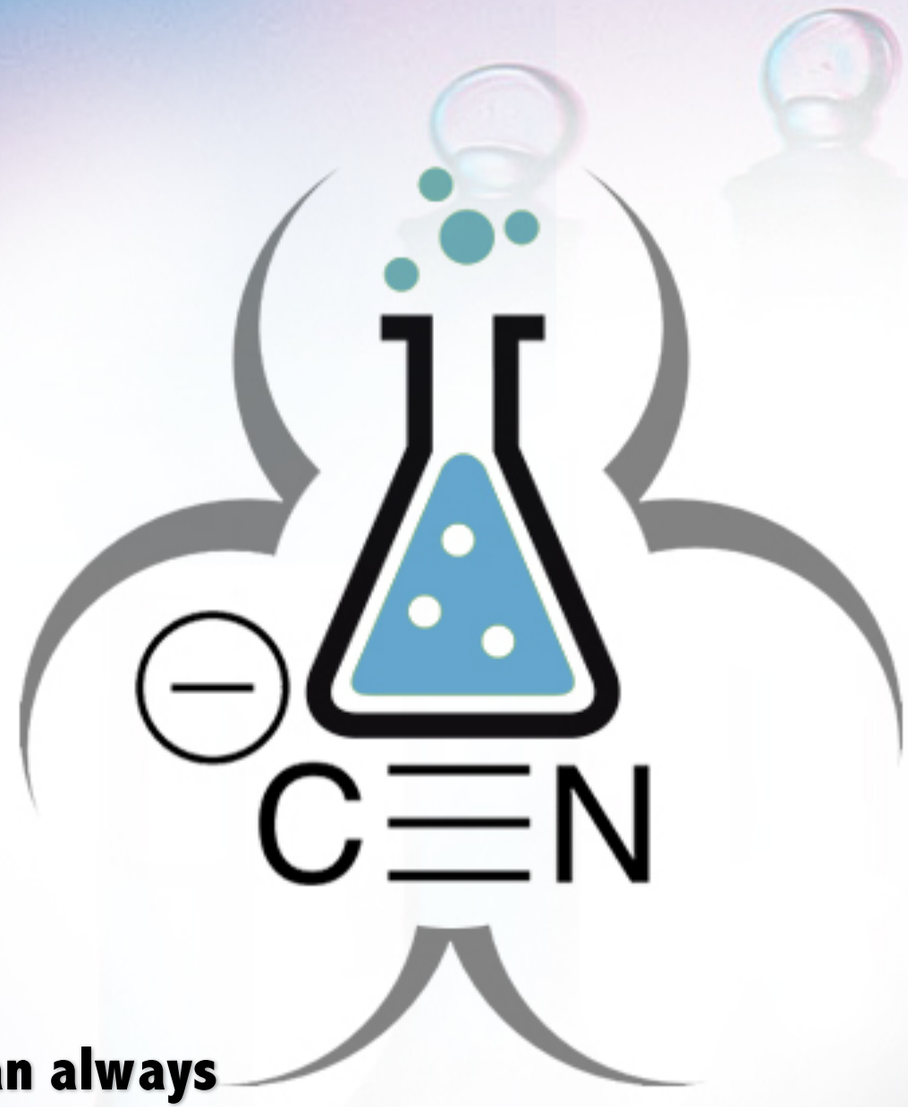
4- Abdominal injuries :

Penetrating injuries:

- **Depend almost entirely on the organs and vessels involved**
- **A penetrating injury to the aorta, or inferior vena cava, can result in severe hemorrhage and may produce rapid death.**
- **Peritonitis from a ruptured bowel or stomach may not be recognized until too late.**
- **Post-mortem: peritonitis and blood clots are both factors which may give indications of how long before death intra-abdominal trauma had occurred.**

Figure 9.15 Mesenteric bruising and laceration following blunt force trauma in a road traffic collision.

Figure 9.16 Multiple lacerations of the liver following blunt force abdominal trauma in a road traffic collision.



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