

Pedestrian Hit by Car: Injuries and Reconstruction

KUHS MBBS FMT Exam-Oriented Study Notes

Case Orientation

- A pedestrian hit by a car usually sustains **blunt force injuries** in a sequential pattern.
- In the given case, **tibial fracture, scalp contusion, skull fracture and brain contusion** help reconstruct the accident.

1. Classification of Pedestrian Injuries



2. Primary Impact Injuries

Primary impact injuries are caused by the **first impact of the vehicle** on the victim.

Features

- They indicate the part of the body struck first by the vehicle.
- In adults hit by a car, the bumper usually strikes at the level of the legs or knees.
- Common injuries include: **abrasions, contusions, patterned bruises or imprint abrasions from bumper, radiator grill or tyre, and fractures of tibia and fibula.**

Bumper Fracture

- A characteristic primary impact injury.
- It is usually a **comminuted wedge-shaped fracture of tibia and fibula.**
- In the given case, the **tibial fracture** represents the **primary impact injury.**

3. Secondary Impact Injuries

Secondary impact injuries are caused by the **second impact of the body with the vehicle** after the primary impact.

Mechanism

- After the legs are struck, the pedestrian may be **scooped up** and thrown onto the vehicle.
- The body may strike the **bonnet, windscreen, side pillars or roof.**

Common Injuries

- Scalp contusion.
- Head injuries.
- Facial abrasions and lacerations.
- Chest and arm injuries.
- Rib, spine or other skeletal fractures.
- **Dicing / sparrow-foot marks** due to shattered windscreen glass.
- In the given case, **scalp contusion** may be due to impact of the head against the bonnet or windscreen.

4. Secondary Injuries / Tertiary Impact Injuries

Secondary injuries are caused when the victim is thrown off the vehicle and strikes the ground or another object.

Features

- Often more lethal than primary injuries.
- Commonly involve **head, chest and pelvis**.

Common Injuries

- Extensive abrasions or **skidding brush burns**.
- Lacerations over bony prominences.
- Skull fracture.
- Spine fracture.
- Brain contusion, including **contrecoup injury**.
- In the given case, **skull fracture and brain contusion** are likely due to the head striking the road surface after the victim was thrown down.

5. Whiplash Injury

Whiplash injury is an **acceleration-deceleration injury of the neck**.

Mechanism

- Sudden **hyperextension followed by hyperflexion**, commonly in rear-end collision.
- Or **hyperflexion followed by hyperextension**, as in sudden stopping or frontal collision.

Findings

- Pain and stiffness of neck.
- Headache, dizziness, numbness or tingling.
- Injury to cervical ligaments, discs and facet joints.
- Subluxation or fracture of cervical vertebrae, commonly at **C5-C6**.
- Spinal cord concussion or contusion may occur.
- It is more common in occupants of vehicles, but similar acceleration-deceleration forces may occur in pedestrians during violent impact.

6. Common Causes / Mechanisms of Death

Category	Causes / mechanisms
Common / early	Head injury - most common. Skull fracture, brain contusion, intracranial haemorrhage and cerebral oedema. Fracture-dislocation of cervical spine, especially at atlanto-occipital joint . Haemorrhagic shock due to internal bleeding or multiple fractures. Rupture of liver, spleen, aorta or other organs. Traumatic asphyxia or flail chest. Crush syndrome.
Delayed causes	Septicaemia. Fat embolism. Acute renal failure. Multi-organ trauma complications.

7. Reconstruction of Accident from Postmortem Findings

The accident can be reconstructed by correlating the injuries with the sequence of impact.

Finding / factor	Reconstruction significance
Tibial fracture	Represents primary impact injury / bumper fracture . Distance from heel to fracture site gives an estimate of the height of the vehicle bumper . If brakes were applied before impact, the fracture level may be lower due to dipping of the front of the car. In wedge-shaped bumper fracture, the apex of the triangular fragment points in the direction of movement of the vehicle .
Scalp contusion	Suggests secondary impact . Occurs when the pedestrian is scooped up and the head strikes the bonnet, windscreen or frame .
Skull fracture and brain contusion	Suggest tertiary impact / secondary injury due to fall on the road. Skull fracture indicates direct impact with hard surface. Brain contusion may be a contrecoup injury , occurring opposite to the site of head impact due to sudden arrest of the moving head.
Position and movement of victim	Bumper injuries at different levels on both legs suggest the victim was walking or running . Injury to the back of legs suggests the pedestrian was hit from behind . Absence of injury on one leg may suggest the leg was lifted during walking.
Speed of vehicle	At low speed, the victim may be thrown forward or to one side. At high speed, the victim may be scooped up and thrown over the vehicle.
Identification of vehicle	Trace evidence may help identify the vehicle: paint flakes, glass fragments, grease, mud, patterned injuries such as tyre tread or radiator grill marks .

Reconstruction Sequence in the Given Case

- **Tibial fracture** - primary bumper impact.
- **Scalp contusion** - secondary impact against vehicle.
- **Skull fracture + brain contusion** - fall on road / tertiary impact.

8. Legal Classification of Injuries Based on Fatality

- **Simple injury**
- **Grievous hurt** - under **Section 320 IPC / Section 116 BNS**
- **Dangerous injury**
- **Fatal injury**

9. Medico-legal Importance

- Helps reconstruct the sequence of accident.
- Helps determine whether the victim was a **pedestrian, driver or passenger**.
- Helps identify the offending vehicle in hit-and-run cases using: **patterned injuries, tyre tread marks, paint, glass or grease transfer**.
- Helps determine the manner of death: **accidental road traffic accident, suicidal jumping in front of vehicle, homicidal run-over, or postmortem placement of body on road to simulate accident**.
- Toxicological examination of blood, urine or vitreous may be required to detect **alcohol or drugs**, which may indicate contributory negligence.
- The accused driver may be charged under **Section 106 BNS / Section 304-A IPC** for causing death by rash or negligent driving.

Medico-legal Interpretation

Final Opinion Framework

- In the given case, the **tibial fracture** indicates the **primary bumper impact**, the **scalp contusion** suggests impact against the vehicle, and the **skull fracture with brain contusion** suggests fall on the road after being thrown.
- These findings support a pedestrian road traffic accident, but the final opinion should correlate autopsy findings with scene examination, vehicle examination and trace evidence.

One-page Exam Recall Table

Injury type	Mechanism	Examples in notes
Primary impact injuries	First impact of vehicle on victim	Bumper injury; abrasions; contusions; patterned bruises; tibial / tibia-fibula fracture
Secondary impact injuries	Second impact with vehicle after primary impact	Impact against bonnet / windscreen / side pillars / roof; scalp contusion ; dicing / sparrow-foot marks
Secondary / tertiary injuries	Victim thrown off vehicle and strikes ground / object	Skidding brush burns; lacerations; skull fracture ; spine fracture; brain contusion / contrecoup injury