TRANSPORTATION INJURIES

MUDr. Kateřina Stoklásková

pedestrians
bicycles
motorcycles
cars
light vans under 1.5 tons
trucks
buses
trains
airplanes
…

frontal (60-80 %)
rear
lateral
roll-overs
…

- transportation injuries are the **most common** cause of death below the age of 50 years in developed countries

- tissue injuries are caused by a change of rate of movement – **acceleration or deceleration** (measured in ‘G forces’)

Injuries to pedestrians

- injuries are caused by **acceleration** (as opposed to injuries to vehicle occupants, which are caused by deceleration)

- **primary injuries** are caused by the first impact of the vehicle on the victim- usually legs and hips
- **secondary injuries** are caused by subsequent contact with the ground

Injuries to pedestrians

- depending on the profile of the front of the car, the struck pedestrian is either thrown forwards in the direction of travel if the bonnet-front is high and blunt, or scooped up onto the bonnet top, as with many slope-fronted modern vehicles
  - if **thrown forward**, secondary injuries will be suffered as a result of striking the ground, the body can be **run over** by the vehicle
  - if the impact is on the front corner of the car, the pedestrian may be knocked diagonally out of the path of the car and can be run over by a different vehicle overtaking in another lane or coming in the opposite direction
  - if **scooped up**, the victim will land on either the bonnet or against the windscreen or corner-supporting pillar (the A-frame)
  - scooping-up can occur at speeds as low as **23 km/hour**, pedestrian may then fall off **sideways** or when the speed is higher may be thrown **over the roof**, if the driver applies the brakes violently the body may slide off **in front of the car**
  - in a high-speed impact (over **50 km/hour**) the body can be **flung high in the air**

Injuries to pedestrians

- child victims
  - the primary contact is higher up their body, so they tend to be hit forwards rather than rotated upwards
  - they tend to be projected further by impact and may be hurled in the air at lower speeds compared to adults
  - they are more prone to be run over by reversing vehicles

- larger vehicles (van, truck, bus)
  - the initial point of impact is higher
  - because of the flat profile there is no scooping-up effect and the victim is usually projected forwards

Injuries to pedal cyclists

- less severe counterpart of motorcycle lesions, as the pedal cycle has the same instability but far lower speeds

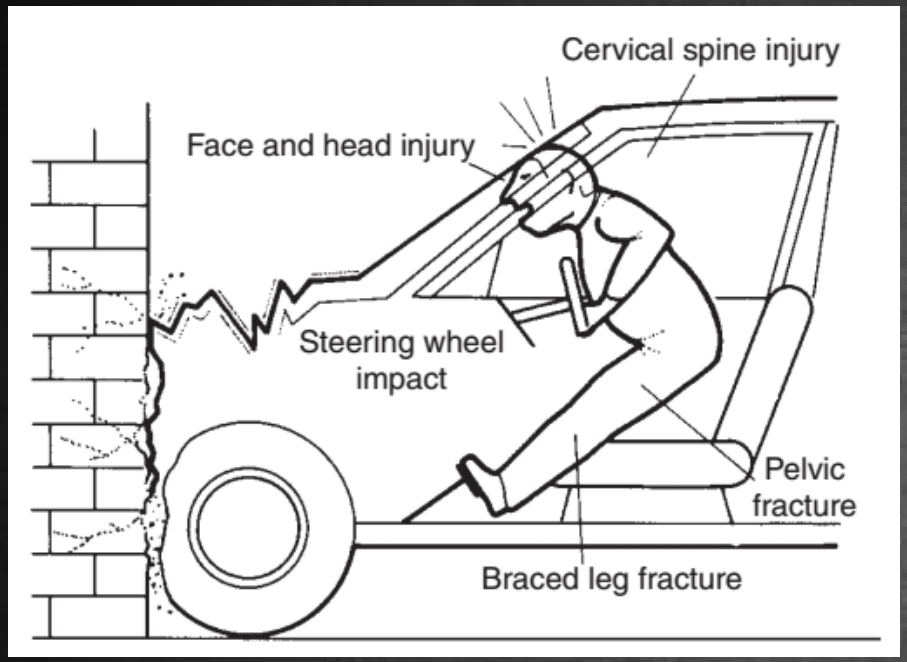
- injuries from primary impact
- secondary injuries from passive falls- head injuries,…

Injuries to motorcyclists

- because the rider inevitably falls to the ground, **head injuries** cause majority of deaths
- crash helmets are mandatory in the Czech Republic, but the severity of impact often defeats the protective effect of the helmet
- typical skull fractures:
  - temporal-parietal
  - hinge fracture, motorcyclist´s fracture- transverse crack across the floor of the skull, crossing the petrous base or behind the greater wing of the sphenoid bones through the pituitary fossa to the opposite side
  - ring fracture around the foramen magnum in the posterior fossa caused by an impact on the crown of the head

- *'tail-gating' accident*- rider drives into the back of a truck so that the machine passes underneath, but the head of the motorcyclist impacts upon the tail-board

Injuries to vehicle occupants- unrestrained driver



- **the body is moving forward and upwards**

- head strikes the upper windscreen rim or the side pillar
- flexion of the cervical and thoracic spine
- chest and abdomen colide with the steering whell
- legs strike the parcel-shelf area

- any protruding parts of the interior can cause injuries
- the body can be ejected through the broken windscreen

in a rear impact the head is moving forward and than backwards – **whiplash injury** (hyperflexion-hyperextension sequence)

Injuries to vehicle occupants- front-seat passenger

- no steering wheel- nothing to brace against to reduce the the collision with the windscreen
- does not pay as much attention to the road as the driver

Injuries to vehicle occupants- rear-seat occupants

- unrestrained occupants are projected forward towards the soft back surface of the front seats, may cause an injury to other occupants or be ejected from the vehicle

Seatbelts

- reduce deaths and serious injuries by 20-25 %
- in the Czech Republic compulsory for all vehicle occupants
- usually „three point attachement“- lap-strap and shoulder
- with the area of **500 cm^2** they decrease the force applied per unit area during deceleration

References: Knight´s Forensic Pathology, 2004