Injury pattern in Road Traffic Accidents

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Why are we so concern about RTAs?

- *All modes of transportations could result in serious and fatal accidents.*
- *Death or disability of different degrees could occur.*
- *A commonly encountered type an accidents – Clinical or pathological*

- *The first motor vehicle accident in England occurred in 1896 when Bridget Driscol, a pedestrian was hit by one of three cars giving a demonstration at Crystal Palace, London.*
- *The cars were said to be zigzagging at high speed – being over 4mph.*
- *She died rapidly from head injures received due to the accident.*
- *Number of motor vehicles have increased and the speed they achieve is much more than 4mph.*

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- *In Sri Lanka the situation is far more dangerous than most other countries as we have much faster vehicles capable of 'zigzagging' at very high speed like - Three wheelers,*

  Private buses,

- *Complicating matters there are dangerous places like pedestrian crossings, junctions with colour lights.*


Dehiwala
Father
Children
Mother
Colombo
ST Graphic

Causes of Motor vehicle accidents:

- *Impairment of the driver – Alcohol, Drugs, etc.*
- *Human factors – speeding, recklessness, falling asleep etc…*
- *Environmental hazards – wet and slippery roads, bad roads,*
- *Natural diseases – MI, Fits, hypoglycaemia etc..*

Types of Accidents

- *Accidents involving one or more motor vehicles.*
- *Accidents involving Pedestrians.*
- *Accidents involving motorcycles.*
- *Accidents involving pedal cyclists.*

Motor Vehicle Accidents;

- *These involve*
  - *Driver,*
  - *Front seat passenger,*
  - *Rear seat passengers*

Types of MVA

- *Frontal collisions*
- *Side collision*
- *Rear impact*
- *Roll over*

Frontal collisions

- *Commonest of all four.*
- *Nearly 80% of MVAs.*
- *Two vehicles colliding with each other.*
- *Colliding with a stationary object.*
- *Vehicle occupants thrown forwards.*
- *Hit various parts inside the vehicle.*

Injuries to Driver :

- *Head –*
  - *Might impact on the windscreen, rear view mirror etc.*
  - *Cuts, abrasions to forehead, nose, chin etc.*
  - *Rear view mirror might cause distinctively recognizable cuts.*
  - *Hyperflexion and hyperextension injuries of the neck.*
  - *Posterior atlanto-occipital dislocation due to hyperflexion.*
  - *Basillar skull fractures.*
  - *Diffuse axonal injury.*

Chest:

- *Injuries resulting mainly by hitting the steering wheel.*
- *This is reduced by seat belt and also due to collapsible steering column.*
- *Injuries –*
  - *Patterned abrasions and contusions.*
  - *Transverse fracture of the sternum.*
  - *Bilateral rib fractures.*
  - *Puncture injuries of the lungs.*
  - *Cardiac injuries – contusions, lacerations, rupture.*
  - *Aortic transection – distal to left subclavian and junction of descending and abdominal aorta.*
  - *Injuries to liver and spleen.*

Upper limbs:

- *Metacarpal, fractures- tight gripping of the steering.*
- *Wrist fractures – extended joint and force transmission.*
- *Shoulder dislocation – extended elbow and force transmission.*

Lower limbs:

- *Contusion on sole – usually the right foot without foot wear due to forceful breaking.*
- *Metartarsal fractures due to breaking.*
- *Ankle fractures – breaking.*
- *Patella and Femur fractures due to impact on the dash board.*
- *Posterior dislocation of the hip – usually right side.*

Other injuries:

- *Force applied on breaking is transmitted from sole across ankle, knee, hip, sacro-iliac joint, vertebral column up to atlanto occipital joint.*
  - *Sacro-iliac joint dislocation,*
  - *Vertebral dislocations,*
  - *Fracture atlanto-occipital joint,- this may even driven in to the skull.*

Front seat passenger:

- *Tend to be the same as those for driver. But no steering column and no break pedal to break.*
- *Therefore injuries due to forceful breaking and striking steering wheel are absent.*
- *Hit the dashboard.*
- *Ejection probability is more in comparison to driver.*
- *Hyperflexion, hyperextension injuries are same.*
- *Head injuries are also same*

Rear seat passengers:

- *Thrown forwards.*
- *Hit the front seats, might even in to the front compartment, and even could hit the windshield.*
- *Any type of injury could occur but less frequent.*

Miscellaneous injuries:

- *Dicing injuries –*
  - *Rear windshield and side windows are made of tempered glass.*
  - *Shattered in to small cubes.*
  - *Cause small cut- bird foot like…*
  - *These are called 'dicing injuries'.*
  - *Driver – commonly on right side of the body.*
  - *Front seat passenger – left side of the body*


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Seat belt

Seat belt:

- *Reduce injuries by preventing the occupants being thrown forwards.*
- *But at the same time it also causes some injuries –*
  - *Abrasion/contusion – angling down from right shoulder towards left lower region of chest/abdomen.*
  - *Lap strap causing horizontally lying injuries.*
  - *Splenic injuries common in drivers.*
  - *Liver injuries common in front passenger.*
  - *In rear seat passengers it depends on the side the occupant is seated.*


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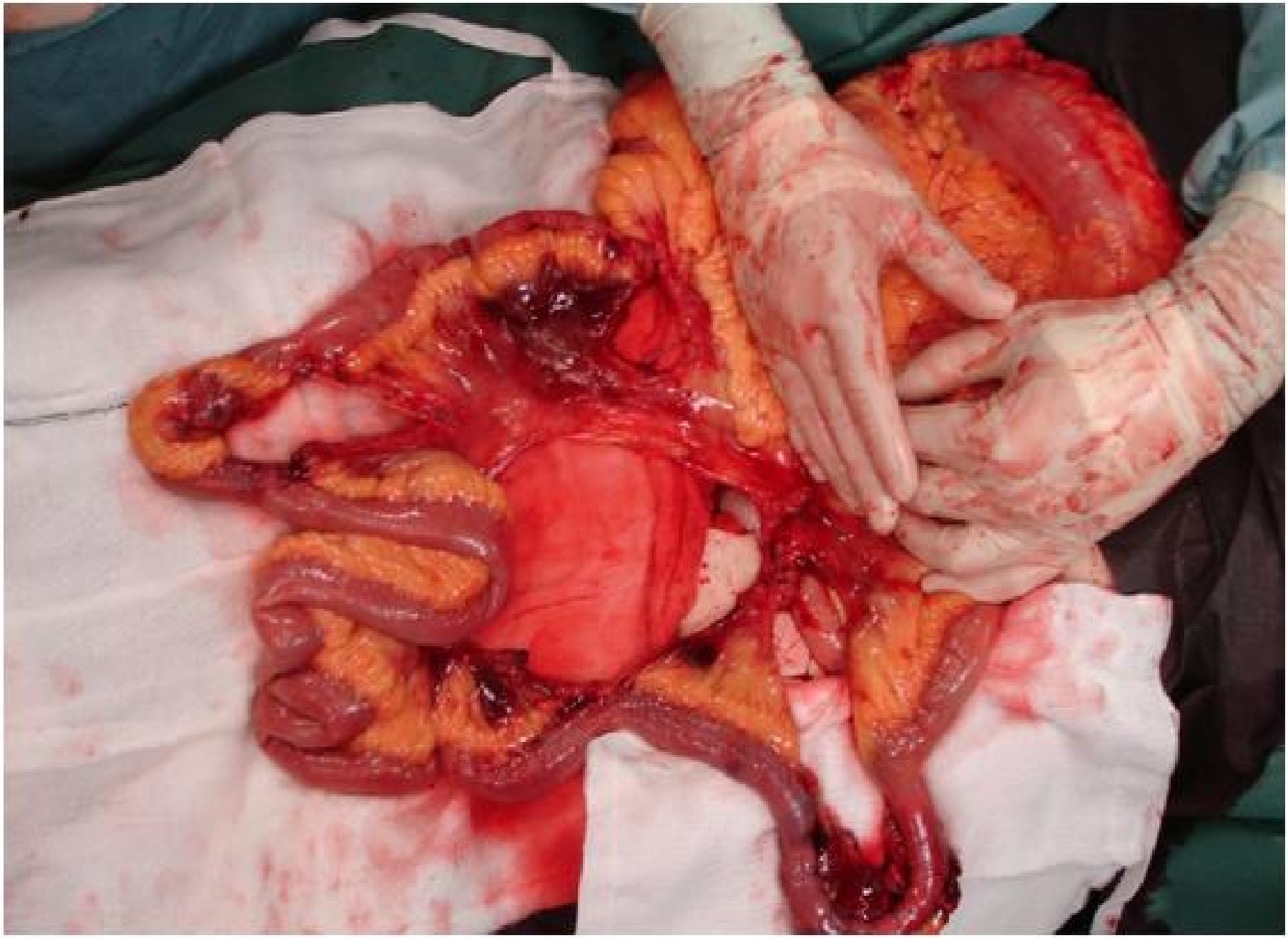


No Seatbelt!

How far will the driver fly forward while the car is stopping?

Stopping distance of car

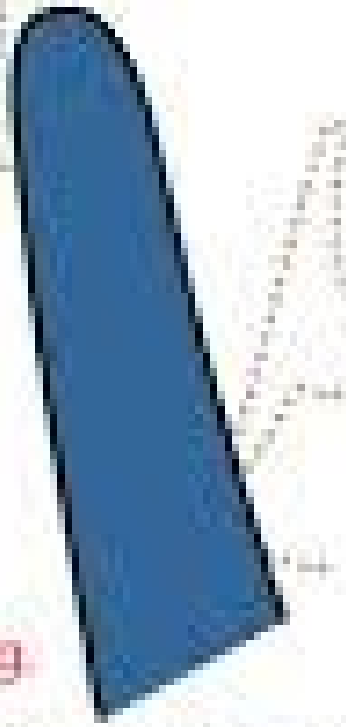
1 ft

Time to stop car

$\frac{1}{22}$ second.

Driver flies forward at 44 ft/s and travels 2 ft while the car is stopping.

If car is originally traveling at 44 ft/s and has constant deceleration the average speed is 22 ft/s while stopping.



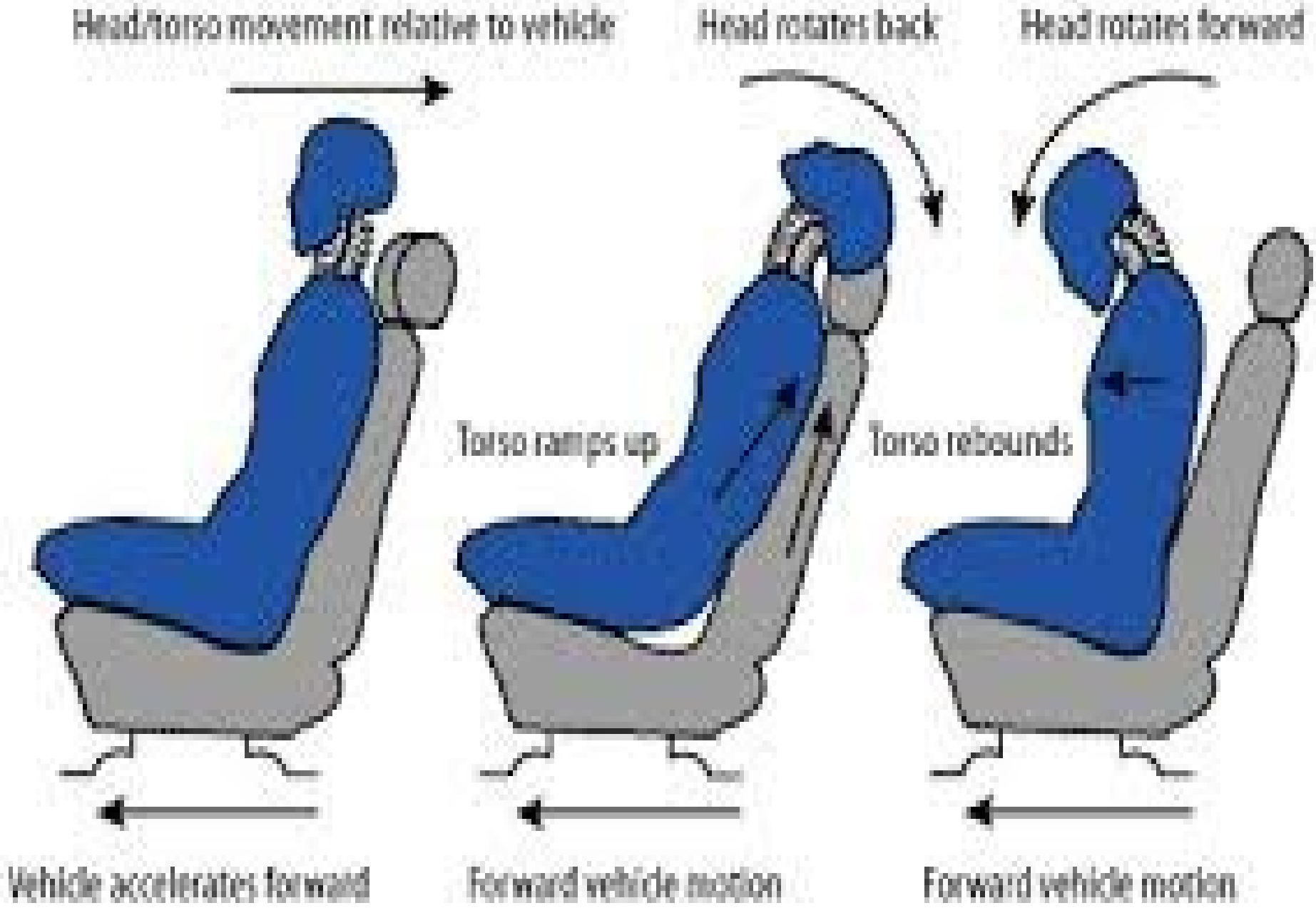
From example car crash scenario with car stopping in one foot distance from a speed of 30 mi/hr.

Air bags:

- *Asphyxia when the occupant falls face down unconscious on to the inflated airbag.*
- *Common in front compartment occupants.*
- *Children are more vulnerable.*

Neck injuries:

- *Sometimes the seat belt increase the hyper-flexion and extension injuries especially when there is no head rest.*
- *Body is fixed in relation to the neck and head.*
- *Whiplash injury to neck.- mainly in rear impact crashes.*


Head/torso movement relative to vehicle
Head rotates back
Head rotates forward
Torso ramps up
Torso rebounds
Vehicle accelerates forward
Forward vehicle motion
Forward vehicle motion

Side impact and rear impacts.

- *Injuries depend on the severity of the crash.*
- *In side impact may see the same injuries as in frontal impact.*
- *Rear impact whiplash injury is common.*

Roll over.

- *Vehicle is toppled and rolled over.*
- *Occupant may be ejected if they are unrestrained.*
- *Might be stuck inside if they are restrained.*
- *Full ejection injuries depend on objects struck by the victim.*
- *Partial ejection might cause traumatic asphyxia and amputation of body parts.*

- *Vehicle might catch fire – conflagration causing various degree of burns and even charring*

Pedestrian injuries:

- Depend on several factors - mainly four;
  - Speed of the vehicle – high speed and low speed.
  - High speed with minimal braking the victim is picked up and thrown over the vehicle.
  - Low speed with no braking picked up and slide backward along the bonnet and roof. Might fall side ways.
- Type of vehicle.
  - Small vehicle hit below the centre of gravity.
  - Vehicles with bonnet and bumper cause bumper fractures.
  - Large vehicles throw the victim forward.

- Braking.
  - Hard braking front end dips and likely to hit below the centre of gravity.
  - Victim is scooped up.

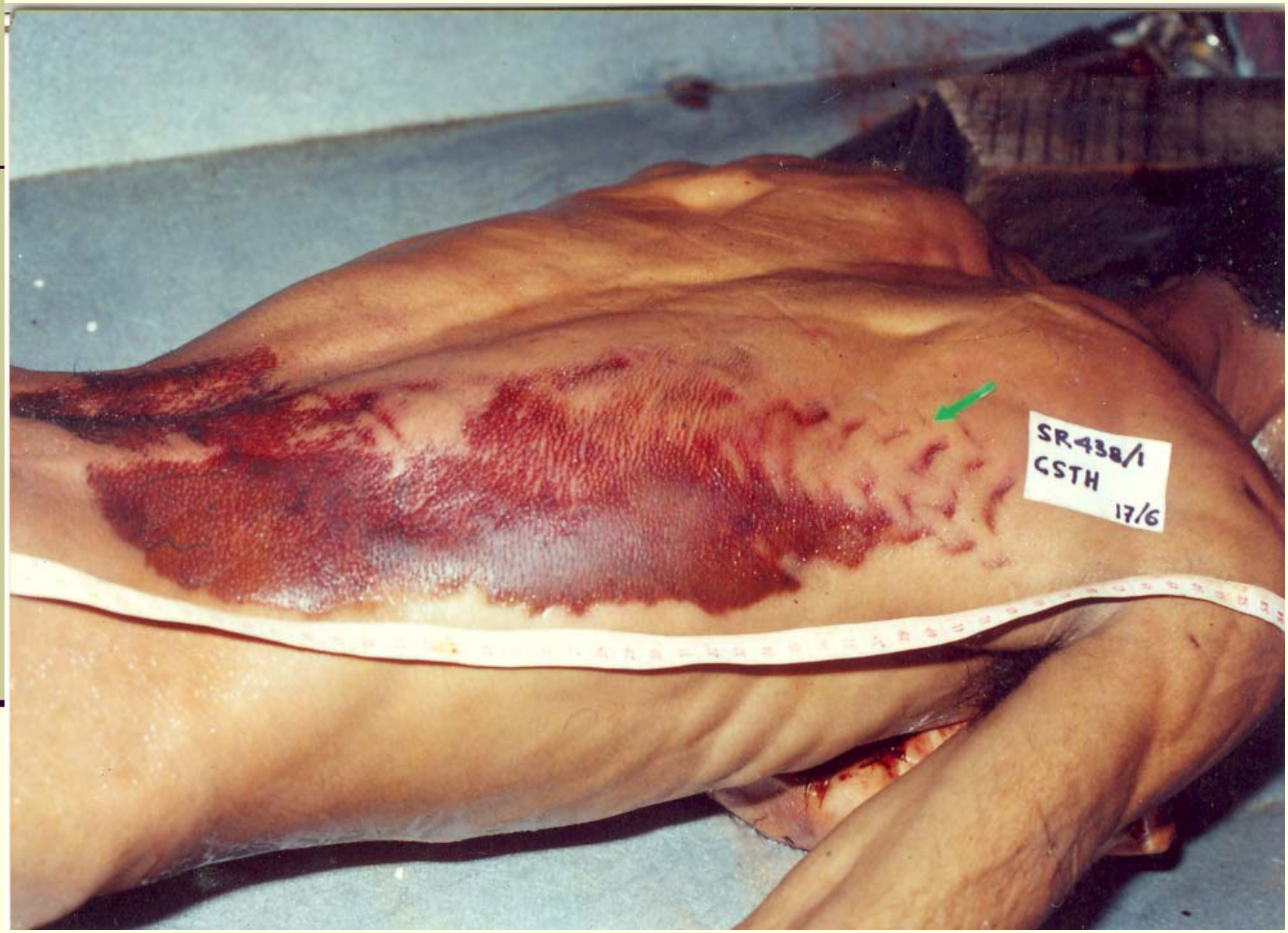
- Size of the victim – mainly the height.
  - Children commonly hit above the centre of gravity and thrown forward and may even run over.

Bumper fracture.

- Involve one or both legs.
- Location of the injuries might indicate the side of impact.
- Height from the sole gives the bumper height – might be helpful in detecting the vehicle.
- Variation occur – leg lifted up gives a lesser height etc.
- Wedge shape fracture of bones – direction of force towards the base.

Run over accidents;

- Characteristic tyre mark imprint may be seen.
- May be absent over clothing areas.
- Documentation and photography is important.
- Could be use in detecting the vehicle.
- Distant between two parallel imprint not necessarily gives the distant between two front or rear wheels.
- It is usually the front and rear wheal which runs over.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motorcyclists

- *More prone to injuries as body is exposed.*
- *Head injuries commoner especially when not wearing helmet.*
- *Diffuse axonal injury when they are thrown to a distant and hits the ground.*
- *Fracture of lower limbs when hit by another vehicle.*
- *Burns of lower legs when comes in contact with the exhaust.*
- *Traumatic asphyxia when thrown off and cycle comes to rest on the victim.*

Medico –legal issues;

- *Circumstances of injuries/death,*
- *Differentiation of the driver and front seat passenger (FSP),*
- *Associated precipitation factors,*
- *Category of hurt,*
- *Amount of disability,*
- *Influence of Alcohol if any,*
- *Reconstruct the event,*
- *Tracing offending vehicle(s)*
- *Cause of death*

Investigation:

- *Detail history.*
- *Thorough external examination.*
- *Document all injuries.*
- *Try to classify the injuries – or group them.*
- *Try to find impact injuries – primary, secondary and tertiary.*
  - *Primary – first contact with the vehicle.*
  - *Secondary – second contacts.*
  - *Tertiary – objects other than the vehicle.*

- *Obtain trace evidence – especially in hit and run accidents.*
  - *On vehicle – hair, blood, skin tags, clothing imprint on hood etc…*
  - *In victim – paint chips, tyre marks, grease from under carriage, glass particles etc..*
- *Toxicology - Alcohol and drugs.*

Circumstances;

- *Almost always accidental.*
- *Suicides occur but rare.*
- *Homicidal cases are reported.*

Who is the driver?

- *This might be a 'burning' question.*
- *It is your duty to determine if possible.*
- *Person who drove the vehicle might be a person;*
  - *Without a license,*
  - *Underage,*
  - *Drunk,*
  - *father and son –and father is trying to take the responsibility.*

Injury pattern will help you to do this in most occasions

- *Steering wheel impact injuries in the driver,*
- *Direction of the seat belt mark/injury –*
  - *Right shoulder to left flank in driver*
  - *Left shoulder to right flank in the FSP.*

  Lower limb injuries –
  - *right sided injuries,*
  - *Post dislocation of right hip – braking,*
  - *Imprint of the brake pedal on right sole*

- *Upper limb injuries – due to tight gripping of the steering wheel.*
- *Dicing injuries in side impact - R/S of the body in the driver*

Cause of death;

- *Immediate cause depending on the injuries.*
- *Consider whether injuries are compatible with a MVA.*
- *Consider the presence of natural diseases and there effect on causing the death and accident.*
- *Accident might be the result of some natural disease – hypoglycaemia, fits etc….*

Railway track accidents

Types accidents

- Colliding with another train;
  - Head on
  - From behind
- Derailment
- Colliding with vehicles crossing the railway line
- Colliding with people crossing the road.
- Falling off the train
- Suicides.

Colliding with another train;

Derailment

Colliding with vehicles crossing the railway line

Colliding with people crossing the road.

Not only humans, even,

Falling off the train, Suicides.

Injuries depend on the position;

- *Side impact – injuries on the side.*
- *Walking along the track - either from behind or front.*
- *Severe injuries.*
- *Projected parts might cause peculiar injuries.*
- *Usually involves a wider area - due to the size of the train*
- *May be thrown off*
- *Run over*

Run over injuries –
struck while crossing/walking along thrown down and run over

Traumatic amputations;

Severe mutilating injuries.

Suicides lying across the track.

Medico legal issues;

- *Circumstances,*
- *Cause of death,*
- *Reconstruction of the event,*
- *Identification,*

Is he/she dead or alive before the apparent accident?

- *Naked body – suggest foul play,*
- *No foot wear but no dust/grease on soles – foul play?*
- *Presence of injuries not compatible with rail track accidents – foul play? -? Killed and dumped*
- *Presence of previous deformities/disabilities - CVA/paralysis etc.*
- *Intoxications/poisoning*


BOOKS
CRASH!
If you have
suffered an injury at the
hands of a reckless driver
then you may be entitled
to 100% Compensation.

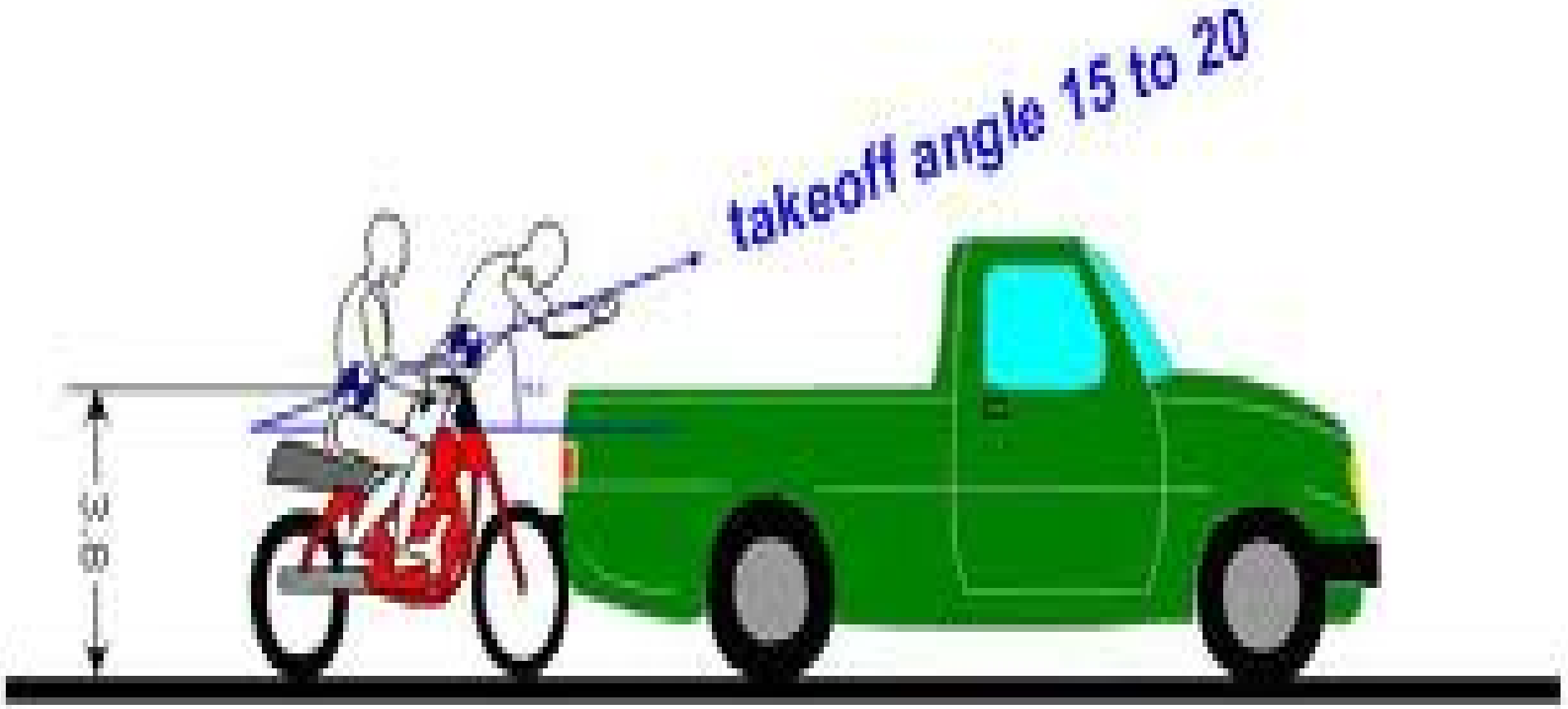

Diagram 1


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Thank you