Case Study

A Cyclist's Catastrophe: An Unusual Case of Road Traffic Accident with A Unique body Trajectory of the Victim, and Associated Baffling Injuries, Defying Stereotypes

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How to cite this article: Senjuti Ghosh, Chandan Bandyopadhyay. A Cyclist's Catastrophe: An Unusual Case of Road Traffic Accident with A Unique body Trajectory of the Victim, and Associated Baffling Injuries, Defying Stereotypes. Indian Journal of Forensic Medicine & Toxicology / Vol 20 No. 1, January - March 2026

Abstract

Introduction: Fatalities from road traffic accidents have resulted in loss of life and material resources. In India, 1374 accidents and 400 deaths take place every day, due to RTAs. Globally, RTA is the main cause of death among the 15–to 29-year-old population. Thus, all such cases must be meticulously studied to identify the mechanisms and causations to reduce such mishaps.

Case History: A young man, riding on a bicycle, was dashed to death by an unknown vehicle running perpendicular to his trajectory. He was declared brought dead by the EMO upon arrival at a tertiary care hospital. Accordingly, a post-mortem examination was conducted.

Autopsy Findings: On external examinations, rigor mortis was present. Multiple incised-looking lacerations were noted, including those in the scalp, and all over the face and neck, anterior chest wall, shoulders and upper extremities. On dissection, the base of the skull fractures and the combination of various intracranial haemorrhages were noted. The conspicuous finding was the presence of a very minimal number of abrasions over the body.

Discussion and Conclusion: The injuries, produced by unusual mechanics, baffled the autopsy surgeons by simulating multiple chop wounds. Reconstruction of the event with the help of information forwarded by the police and crime scene photographs solved the puzzle.

Keywords: Road Traffic Accident, Bicyclist Impact, Body Trajectory, Lacerations, Chop wound.

Introduction

"Accidents are not accidents but precise arrivals at the wrong time."

A road traffic accident (RTA) is any vehicular accident occurring on the roadway that originates on, terminates on or involves a vehicle partially on the roadway[1]. Road traffic injuries are expected to take third place in the rank order of disease burden by the year 2027.[2] Worldwide, the number of people killed in road traffic crashes each year is estimated to be around 1.2 million, while the number of injured could be as high as 50 million[3], contributing to a major non-communicable cause of death all over the world.

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Submission: Aug 1, 2025 **Revision:** September 2, 2025 **Published date:** January 29,2026

The essential driving force in an RTA is a tremendous, instantaneous, blunt force.

1. Primary impact- Struck by the bumper of a car and by the front of the bonnet, which injures the upper part of the leg or pelvis.
2. Secondary impact- a person is rotated so that the upper half of the body, head, shoulders and chest are thrown against the bonnet or windscreen
3. Tertiary impact- The Victim falls off the front of the car, finally coming to rest after sliding across the road surface. The greatest abrasions, contusions and lacerations are sustained here.

Several Subcategories of the same would be

1. Flat projections/over injuries- flat-fronted vehicles, the victim is thrown forward onto the road surface in front and is exposed to subsequently being run over.
2. The wing top person is struck by the front corner of the vehicle and is carried over the wing, falling to the ground at the side or behind of vehicle.
3. Rooftop occurs either at high speeds or when a vehicle accelerates after impact. Victims slide up the windscreen and over the roof.
4. Somersault - A feature of high speed that occurs when the lower part of the body somersaults to the ground.

In the following report, we have presented a case of a road traffic accident between an unknown vehicle and a bicycle. What makes this case essentially unique or off the record is the unusual set of injuries sustained by the victim, and the complex interplay of factors that led to the genesis of the same, a few of which we have been attempting to explain henceforth.

Case History

The deceased was shifted to a Medical College and Hospital in Kolkata, with a history of being dashed by an unknown vehicle and resultant injuries on 26.05.24 at about 17:30 hrs. He was declared dead by the on-duty EMO at the Medical College and Hospital, Kolkata, on 26.05.24 at 18:25 hrs.

Autopsy Findings

External Findings

1. Average built and nourished male subject, rigor mortis present all over the body.
2. Conjunctivae congested corneas hazy.
3. Blood is coming out of both the ears and the nostrils.
4. Multiple lacerated wounds on the scalp, in the parietal and occipital regions, the largest measuring around 2"x 0.6"x muscle.
5. Multiple incised-looking lacerated wounds- along an oblique line starting from the lateral margin of the right eyebrow across the face, the anterior aspect of the neck, and the left half of the anterior chest wall, the largest measuring around 5"x2"x muscle. (Fig. 1, Fig. 2, Fig. 3)

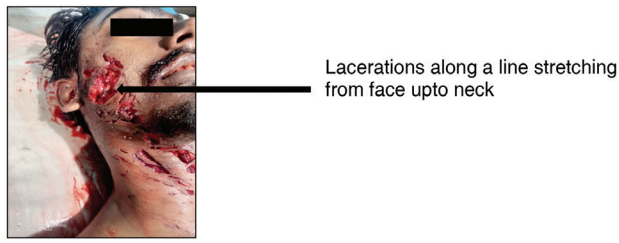


Figure 1

Figure 2

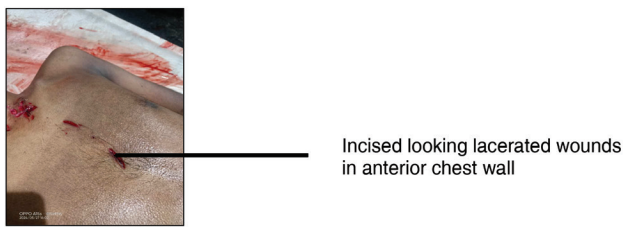


Figure 3

6. On dissection, neck wounds show diffuse extravasations of blood in and around. (Fig. 4)

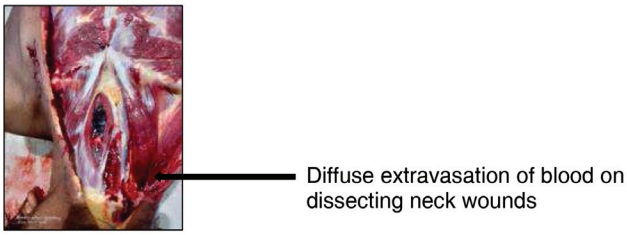


Figure 4

7. Lacerations are noted on the right clavicle, suprasternal notch, posterior aspect of left arm, forearm, and left elbow, left foot, the largest one with the dimensions 4.5"x2"x muscle. (Fig. 5)

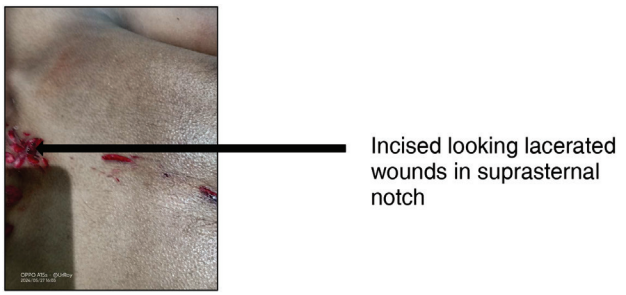


Figure 5

8. Minor abrasions are present over the right shoulder and left knee joint, showing extravasations of blood on dissection.
9. One bruise over the right knee joint

Internal Findings

1. Diffuse extravasations of blood into the layers of scalp tissue involving the right parietal and occipital regions- corresponding to the lacerations over an area of 6" x 4.5" (Fig. 6)

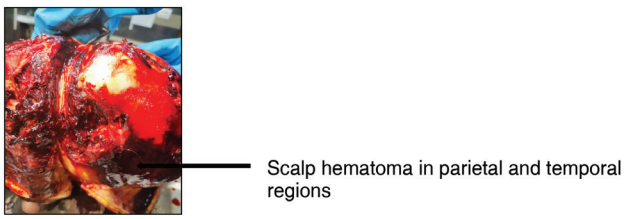


Figure 6

2. Global Diffuse Subdural haemorrhage involving the cerebral and cerebellar hemispheres of both sides. (Fig. 7)

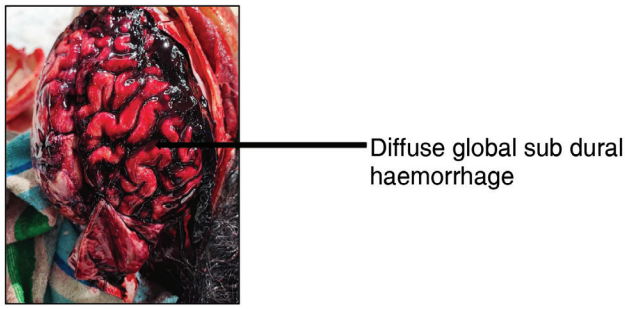


Figure 7

3. Fracture of the right supraorbital margin, right side of the base of the mandible, transverse fracture in the anterior cranial fossa. (Fig. 8)

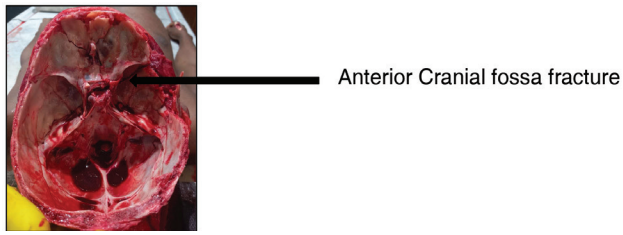


Figure 8

4. Bilateral lung contusion- right lung middle and lower lobes- left lung upper lobe. (Fig. 9)

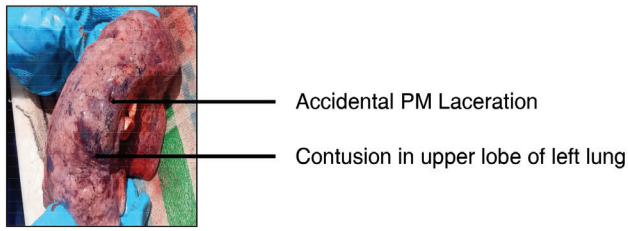
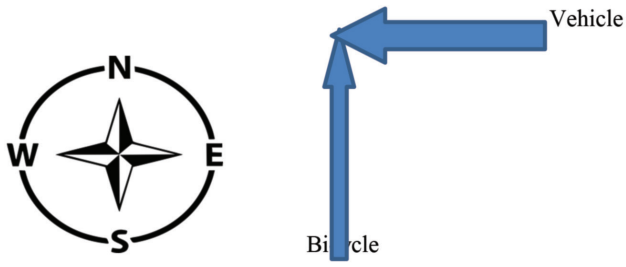


Figure 9

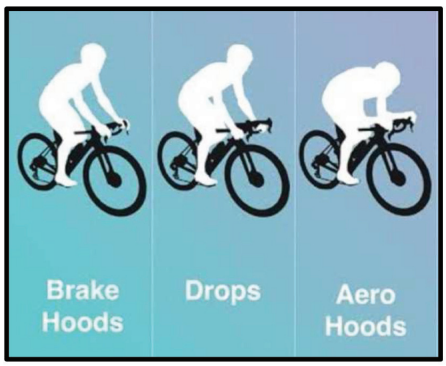
All the injuries noted above show signs of vital reaction.

Discussion

Case Scenario- The deceased was moving on a bicycle from south to North while the vehicle was moving from East to West.



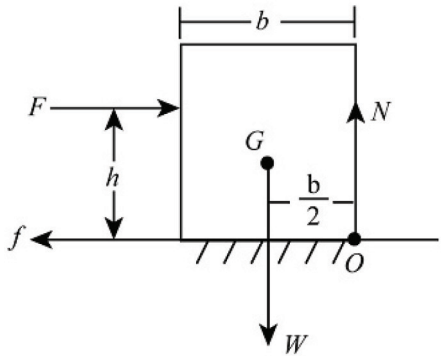
1. Primary impact- When the bicyclist sees the vehicle rushing towards him, there are two options for him: either halt and back off to steer clear or accelerate rapidly to get over the pre-estimated diametric boundary of the vehicle. The latter seems to be the case in this scenario. And for that instantaneous, rapid acceleration, the bicyclist changes the aerodynamic position to gain speed at the cost of losing control over the brakes. This changes the posture from "hoods " to "drops" or "aero hoods", a posture characterised by an almost horizontal forearm on handlebars, arched back and minimisation of frontal surface area. It is at this spot that the head protrudes ahead, assuming an almost "4-legged animal" posture.[6] A sudden blunt hit to the facial and thoracic region (to the forward-pushing half of the body) could be held accountable for the acute absence of abdominal trauma. The facial hitcaused the supraorbital and mandibular base fractures.



Also, since the deceased was on a bicycle, the autopsy did not reveal any blunt trauma to the lower limbs, a characteristic feature of pedestrian injury.

2. Effects of the primary impact-[7]

   a. Rotational component- Riding a bicycle will automatically increase the effective height centre of gravity of the rider(considering the algebraic sum of the COG of the bicycle and the COG of the rider). It is safe to assume that the vehicle had hit the rider at a spot below the centre of gravity, thus effectively decreasing the distance of application of force from the point of rotation, causing what is commonly referred to as the "Toppling effect".



The net torque produced will guide an anticlockwise rotational force, propelling the rider towards the bonnet of the vehicle, instead of a run down.

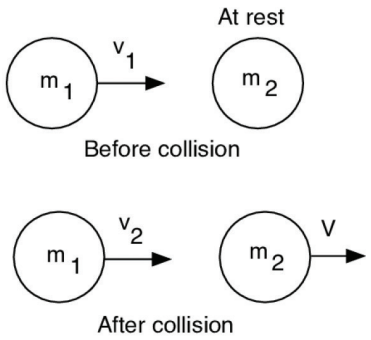
Atypia noticed the presence of bilateral lung contusion, predominantly in the posterior basal and lateral basal segmentsof the middle lobe of the left lung and the apical segment of the right lung, but without the presence of any rib fracture. This shifts our deduction to a contre coup injury rather than a primary one.

A person hits a windshield ⟹ Thoracic viscera undergoes relative motion within ribcage ⟹ opposite to the site of strike, an area of negative pressure is generated ⟹ increase in volume of dissolved gases at pulmonary and bronchial vessels(as per Boyle's Law) ⟹ vessels rupture, creating a local area of decreased perfusion match ventilation perfusion ratio, ventilation is decreased ⟹ peripheral asphyxia.

Lung contusion: Blunt chest trauma → alveolar-capillary damage → haemorrhage + oedema in alveoli & interstitium

This further explains why the heart is found intact and cushioned between the pulmonary viscera.

   b. Translational component- The given case scenario can be pictured as an inelastic head-on collision between an extremely heavy mass and a comparatively lighter mass.



Consider m1 = mass of vehicle,

m2 = mass of bicycle+rider system,

v1 initial velocity of the vehicle,

v2 final velocity of the vehicle

Final velocity of the system.

Here, the bicycle was travelling at right angles to the vehicle before the crash. Since cos 90= 0, we have no component of the velocity of the bicycle in the line of motion of the vehicle, so we have considered the bicycle+rider system to be stationary initially.

Now, following the Law of conservation of momentum for a one-dimensional head-on collision,

$$m1v1 + m2.0 = m1v2 + m2v$$

$$v = m1(v1 – v2)/m2$$

Since $v1 \geq v2$, $v \geq 0$, but this is an absolute velocity.

So when observed from a non-inertial frame of motion, the relative velocity of the rider and the vehicle comes out negative, which means that the rider acquires a force propelling it against the motion of the vehicle, responsible for the characteristic scooping up the vehicle, and ramming possibly against the windshield.

3. Secondary impact injuries- On ramming against the windshield, the consequences were as follows

    a. Extradural haemorrhage, producing diffuse bleeding over the parietal and occipital region under the scalp due to rupture of bridging scalp veins

    b. Transverse fractures (type III) in the anterior cranial fossa, responsible for the presenting feature of bleeding through the nose, are produced by general deformation of the skull. Cerebrospinal rhinorrhea, a possible option, was not inspected for.

    c. Diffuse global subdural haemorrhage, involving bleeding from the cerebral as well as cerebellar parts.

    d. Windshields are made of outer and inner layers of glass with a thicker plastic coating in between. Possibly the forceful propulsion of the right aspect of the rider caused the windscreen to crack and split, producing a long chain of lacerations, coalescing with each other, starting from the lateral aspect of the right supraorbital margin to the lower border of the base of the right jaw, continuing further downwards into the neck region and the anterior chest wall as the rider skids down the windscreen in an oblique direction from superolateral to inferomedial aspect, which then crosses midline of the body and continues on the inferolateral aspect as well.

    Further rolling of the body on the sharp surface could have produced the lacerations on the scalp, coupled with those on the extensor aspect of the left forearm.

    These wounds, at first glance, looked like chop wounds and were misleading, only to be ruled out on further meticulous examination.

5. The strangest atypia in this case is probably the acute scarcity, if not complete absence, of the abrasion marks, the most prominent features of road traffic accidents due to blunt force. This throws light on the fact that possibly the rider had not been inflicted upon the ground due to the slowing down of the vehicle, and thus had not received the tertiary impact injuries due to the rough ground surface. This could also possibly lessen the chances of the case bearing a classical “hit and run” tag, and erode the

malicious or homicidal intent of the driver of the vehicle, presenting the case more to be an "accidental" one.

Opinion after Autopsy

It was opined that death was due to the effects of antemortem injuries.

Consent

Informed consent was taken from -1. Next of kin of the deceased, 2. Investigating Police Officer 3, the autopsy surgeon of the present case, for access to the autopsy room, to capture photographs of significant findings and publish the same, keeping the identity anonymous.

Acknowledgements

To the staff of the Department of Forensic and State Medicine, Medical College Kolkata and to the staff of the Kolkata Police Morgue.

Ethical Clearance: It was granted by the Institutional Ethics Committee of Medical College, Kolkata, with reference number- (Reg. no. – ECR/287/ Inst/WB/2013/RR-24) Ref. no. MC/KOL/ IEC/2818/07/2025, dated 17/07/2025

Source of Funding: None

Conflict of Interest: The authors hereby declare that no conflict of interest regarding funding or publication. The report was made with the author's funds and has not been submitted to any other journal concomitantly.

Conclusion

RTA victims, especially the ones brought dead, bring forth the immense task of a meticulous autopsy. The primary objectives during such an autopsy would be to determine the cause of death, confirm that death was caused by injuries suffered or sustained in the accident, and detect any disease or factor, for example, drugs that could have precipitated or contributed to the accident or death and document all findings for subsequent use in either criminal or civil actions [8]

This is usually coupled with several other investigations for the complete reconstruction of the scene of the RTA, such as the study of the accident scene and mechanical and engineering examination of the involved vehicles, and of each component whose failure could affect safety in motion[9]

With each factor executed to near perfection, it is possible to ascertain the disposition of appropriate judicial measures for all the individuals entangled with the incident.

Abbreviations

RTA- Road Traffic Accident

EMO-Emergency Medical Officer

COG- Centre of Gravity

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