

BIOMECHANICAL DEDUCTIONS OFFERED BY THE SOFT TISSUE'S
MORPHOPATHOLOGY

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The retrospective analysis of 1000 cases of traffic accidents from the point of view of lesion mechanisms of the soft tissues revealed us the fact that the lesions have an unequal value in the evaluation of these mechanisms.

The lesions of those injured in traffic are different if we are considering the vehicle occupants and the pedestrians.

The lesions of the vehicle's occupants peculiarly reflect the pathogenesis of the lesion. In spite of the fact that the victims of traffic accidents are multiple injured, the injury mechanism can be easily systematized. Even if the fate of a car occupant in the moment of the accident is compared with that of "a small stone in a box", the careful research of the lesions allowed us to deduce their way of appearance. This fact is due to the peculiar conditions to which are exposed the vehicle occupants during movement.

During sudden acceleration or deceleration considerable forces are developed. The apparent weight of the body is increasing according to the deceleration degree so that lesions without impact can be encountered (such as a cerebral concussion, aorta rupture, liver rupture or subdural haematoma). These lesions are the result of internal organs movement with an apparent increased weight inside a closed cavity and their strike against the cavity walls, or because of rupture of the cavity organs at their place of fixation (e.g.: the aorta by increased weight of the blood).

Regarding the driver and the other vehicle occupants the lesion mechanism can be one of the following three:

1. A pathogenic lesional mechanism is produced by direct shock and in this case predominant cranio-cerebral lesions will be encountered. These are the results of direct impact following victim's projection inside the vehicle or against external obstacles (in the case of victim's ejection out of the vehicle).
2. Another lesional mechanism, this time specific for traffic traumatology, is represented by lesional results of the kinetic processes and vibrations connected to sudden acceleration and deceleration of a vehicle that modifies the apparent weight of the internal organs.

It was described the sudden cervical deflexion or sudden cervical hyperextension "by whiplash mechanism" able to produce the prominence in the spinal channel of the ligamentum flavum which hits, compresses and crushes the spinal cord. Moreover, the antero-posterior movement of the fractured spine fragments may produce sudden death by spinal cord concussion or even its section. The same type of lesion may appear in the case of sudden acceleration as it happens when a stopped vehicle is hit from behind by another which is moving fast. The same kinetic mechanism explains the rupture of cortical-meningeal venous connexion with the development of subdural haematoma in the absence of any impact, by simple vibration of the brain inside the skull.

3. The third lesional mechanism is the mixed one when to the lesions produced by direct shock adds the lesions produced by kinetic and vibrative mechanisms mentioned above.

The lesions of the vehicle occupants differ according to their place in the vehicle.

In the case of the driver thorax trauma with rib fractures, contusions and ruptures of the heart, traumatic ruptures of the liver and diaphragm as well as astragalian and tibio-tarsian fractures are most frequently encountered.

The right front seat occupant exhibits mostly cranio-cerebral lesions where from the name of "dead man's place" given to this seat because of the seriousness of the lesions encountered.

The other occupants are exposed to centrifugal forces that give different kinds of lesions according to the objects against which the occupant is projected, the topographic area involved, the extent of the impact area and especially the degree of deceleration to which the occupant is submitted.

The lesions of the pedestrians. The lesions by direct shock, direct impact in pedestrians correspond to the impact with the vehicle and are situated on the part of the body that was hit by the vehicle. These lesions, depending on the vehicle's speed are more often represented by ecchymosises, haematomas, contusive wounds and fractures localized on the impact side. Very often there is a full correspondence between the level of the lesion (the level of the impact) and the part of the vehicle that hits (e.g.: pelvis fractures produced by the car's bonnet, that hits, the fractures of ankle's bones produced by the front bumpers etc)

Sometimes the vehicle leaves a mark on the body as a typical stamp (contusion of a head light shape, contusion of a radiator shape etc.).

The pedestrian lesions produced by direct shock are so specific that they allowed the retrospective evaluation of the mechanism of accident occurrence. They allowed us to deduce the characteristics of the involved car and its identification by the impact imprints on its body (soft tissues, blood, hair etc.).

The lesions of the pedestrians produced by projection are more frequently ecchymosises, contusive wounds and fractures located on the opposite side of the impact with the vehicle. The morphological shape of these lesions depend on the shape of the surface on which the victim was projected and the vehicle's speed.

The pedestrian lesions produced by treading are usually the consequence of striking and projection on the highway when will shell find lesions of body treading or treading of segments of the body with the crush of internal organs. The treading lesions have some peculiarities:

- They are mostly serious lesions represented by comminutive fractures with the crush of the organs accomodated in these cavities as the crush of the head, the crush of the thoracic organs with multiple ribs fractures, the crush of abdominal organs or of the pelvic organs.
- Often on the skin we can find the imprint of the tyres which reproduces the tyre's design by parchment-like transformation of contusionated teguments after death.
- The treading by vehicles may produce extremely peculiar lesions as the eye-ball ejection at a distance of aproximately 1 m from the corpse, the intrusion of some liver fragments under the skin at the level of the limbs etc.

The dragging lesions may have a considerable big surface depending on the distance as well as of the aspect of the dragging surface. They are usually multiple vital or postvital scratches, a character that can be established morphologically.

In the case of body collision with a vehicle, the lesions are similar to those produced by compression during treading the only difference being that we can make a more accurate correspondance between the collision's site and the part of the vehicle that did the collision.

These data allowed us to systematize the lesions in the following categories:

- I. Lesions with marker value, extremely specific for a certain type of bioimpact.
 1. For the vehicle's occupants.
 - The cranio-facial lesions by wind shield fragments.
 - The blow-up of the heart and aorta by compression against the steering wheel.
 - Cervical lesions by whiplash injury without bone lesions.
 - The soft tissue lesions of the inferior limbs stucked on the controls.
 2. For the pedestrians.
 - Hiting lesions with the preservation of head lights shape, of car's mask shape or of the vehicle's ornaments.
 - The trading lesions with the preservation of tyres' design.
 - The dragging lesions with the imprint of land surface and of the mouvement direction.

II. Lesions common to more many other type of bioimpact.

- (- treading, collision, dragging, projection -)
- Elementary lesions of the soft tissues - ecchymosises, scratches, haematomas, wounds.
- The distruction of internal organs, sometimes with "sentinel lesions" (skin ecchymosises).

III. Lesions common to more than one type of violence in an injured vehicle:

- Carbon monoxide poisoning in the vehicle.
- Burns by gasoline.
- Drowning in a vehicle.
- Suffocation under a capsized vehicle.
- Acute emphisema by compression.

To summarize, we may say that the retrospective evaluation of the biokinetical mechanisms through the encountered lesions reveals its use fulness not only for the reproduction of the type of impact but also for the accurate evaluation of social and legal implications of bioimpacts.