

The Mechanics of Injury Production and Wounding Forces in Judicial Context

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ARTICLE INFO

Article Type:
Short Communication

Article History:
Received: 22 July 2014
Revised: 30 July 2014
Accepted: 26 Aug 2014

Keywords:
Injury biomechanics
Injury patterns
Wounding force

ABSTRACT

An injury is defined as illegally caused harm to any person's body, mind reputation or property. In practice, injuries often consist of combination of several basic injury types and usually classified according the predominant injury type. The wounding process and distribution of injuring force are governed by equations of motion physics. However, the purpose Legal judgment demands the forensic medical expert, as an independent witness, to explain those complex biophysical remedies in the context of the common legal sense, which can be easily understood by the courts. Therefore, we suggest the following simple biomechanical classification of wounding process that could serve the purpose; light force, moderately heavy force and heavy force injuries.

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► *Implication for health policy/practice/research/medical education:* The Mechanics of Injury Production and Wounding Forces in Judicial Context

► *Please cite this paper as:* Ruwanpura R. *The Mechanics of Injury Production and Wounding Forces in Judicial Context*. *International Journal of Medical Toxicology and Forensic Medicine*. 2015; 5(2): 78-80.

1. Introduction:

Examination of living persons with mechanical injuries accounts for reckoning portion of the forensic medical practice. According to Roman-Dutch legal concepts, prevailing in many Asian countries, an injury has broader meaning that refers to any harm, whatever illegally caused to any person in body, mind, reputation or property. The terms 'wound' and 'trauma' are interchangeably used in medical practice to describe an injury to a part or tissue of the body, especially one caused by physical trauma and

characterized by tearing, cutting, piercing, or breaking of the tissue (1). In reality, most injuries contain mixture of several basic injury types such as abrasions, lacerations, contusions and cuts etc. and usually classified according to predominant injury pattern.

2. The medico-legal Issue:

Expert opinion about the weapon and biomechanics of the wounding process is one of the key medico-legal issues faced by forensic pathologists and clinical forensic experts during their testimony at the court of law. The defense, as well as prosecution is particularly interested about following medico-legal issues; could the injury pattern observed in the victim's body have been caused by the particular weapon recovered by the Police, the approximate quantity of impacting force, the manner of application

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of the weapon etc. The amount of mechanical energy applied on the tissues can be calculated by Newton's second law; Force [P] = Mass [M] x Acceleration [f] which can be precisely calculated on experimental models (2). However the final injuring force of impact is modified by number of physical and biological factors such as size and shape of the striking surface, angle of the application, speed and manner of the impact, weight of the weapon, length of the weapon, sharpness, etc (3).

On the other hand, law enforcement authorities have shown no serious interest in those complicated mathematical calculations and quantitative measurements of the physical energy. The prime concern of the judiciary is to obtain medical opinion about approximate strength of the wounding force in relation to an assault with a given weapon and its possible consequences (4). Often, defense attorneys argue that their clients had no intention of killing or fatally injuring the victim, and the fatal outcome is due to other external factors. The purpose legal judgment demands the forensic medical expert, as an independent witness, to explain those biophysical remedies in the context of the common legal sense, which needs be easily understood by the courts. However, there have been many controversies and a misinterpretation about this clarification of weapons/force among the forensic practitioners itself, which may interfere with balance of the judgment (5, 6).

3. Discussion:

From a physical point of view, an injury is a bodily damage or disruption of anatomical integrity of living tissues due to application of physical forces or chemical agents. Theoretically, a physical force may act on one of the major planes or its intermediate

positions in relation to stature of the body. The external appearances of the injury can be greatly modified according to the plane along which the weapon has been applied, even in multiple assaults using the same weapon with the equal force. However, many types of incidents, including low-speed vehicle impacts, elevator stops, and trips or slips and falls that result in injury claims may or may not be attributable to the incident.

The actual effects of the injuring force that comprise of pressure, tension, crushing and compression, cavitation's, acceleration and deceleration, are governed by number of physical and biological factors such as; size and shape of the striking surface, angle of the application, speed and manner of the impact, weight of the weapon, length of the weapon, Sharpness, Physical and physiological characteristics of the skin surface and subcutaneous structures, internal organs etc. When the forces exceed certain thresholds, injury results (7).

The load refers to outside forces applied on the tissue and stress implies an internal reaction of the tissue. The strain of a tissue explains the extent of the deformity of tissue due to loading. When loading exceeds yield point [elastic threshold of the tissue] mechanical failure occurs causing tissues to break.

According to physical stress theories [PST], the changes in the relative level of physical stress cause a predictable adaptive response in all living tissue. The PST emphasizes the application and modification of physical stress on tissues of the human body to elicit positive adaptations and avoid injury (8). The effects of physical energy are extremely complicated in biomechanics of skull fractures and closed head injuries.

Suggested model of classification of

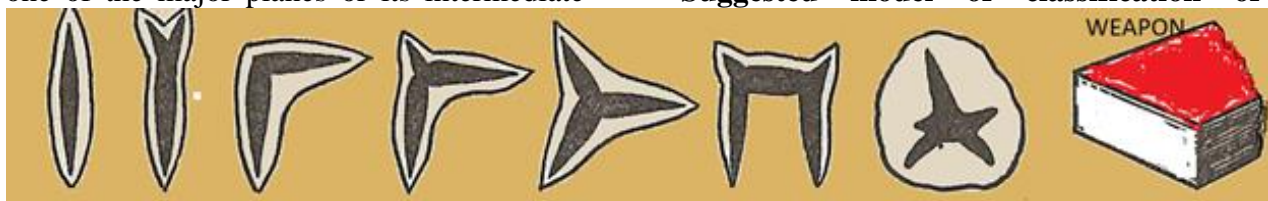


Fig. 1. Lacerations of various shapes produced by impact of the same weapon using different angles. Dark area at the centre represents actual laceration and pale surrounding area is due to contusions and abrasions of marginal tissues.

wounding process. Therefore, author suggests the following simple biomechanical classification of wounding process and impact of the weapons that could serve the purposes judiciary:

Light weapon – [Low force wrist elbow weapon]. A relative lower energy/force delivered during assault with an instrument, which could be naturally handled with movements of the wrist and elbow joints; e.g. bread knife, a screwdriver, a cane or a cycle chain

Moderately heavy weapon - [Single-arm weapon]. A Force produced by an instrument that utilizes the power of the entire upper limb in its usual way of handling; e.g. Sword, hammer, club, a small axe, knuckle duster and etc. The amount of actual energy generated in this case is considerably higher than the light weapon, and may even result in a very heavy force [like a heavy weapon] if impacted with a greater speed.

Heavy weapon – [Bi-manual weapon]. An instrument that needs at least strength of both upper limbs to control it; e.g. Mamoty, a large axe, a rice pounder, an iron rod, and application of which results in a significantly heavy force, generally over 1000N, that would be sufficient to cause grave injuries including severe fractures and deep structural damages

4. Conclusion:

The above explanation of the causative weapon better serves the purposes of medico-legal practice and has successfully been practiced at our unit for last 10 years without facing any serious challenges from the defense attorneys. The suggested classification of weapons provides a simple,

but clearer picture about wounding process which facilitates the better understanding of the biomechanics of injuring forces even by technically incompetent persons.

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