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Multidimensions of Abrasion: Case Series and Literature Review

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ABSTRACT

The scratch is a colloquial term for abrasion, which is a type of mechanical injury and legally classified as simple hurt, because of no bleed tendency, heal without permanent scars and required conservative management in most of the circumstances. In general abrasions are superficial injuries to the skin, mostly characterized by the removal of the superficial layers of the epidermis. Abrasion is the most commonly encountered wound in clinical and forensic practice.But we didn't come across any case report or series, regards to forensic and medicolegal aspects of abrasion on extensive search. Hence this case series reinforces existing knowledge of medical professionals, and also guides clinical and medico legal works in new perspectives. In this case series, four cases of medicolegal autopsy are solitarily interpreted based on gross findings of abrasion injuries, though abrasions are almost not fatal in nature and don't contribute to cause of death except few circumstances like an infected wound, but it gives crucial information for clinical and medico legal works. Every big problem has a simple solution and a small key opens big doors; similarly unsolved mysteries forensic cases can be solved with simple injury such as abrasion.

Keywords: Abrasion; Scratch; Graze abrasion; Injury; Wound; Simple hurt

INTRODUCTION

The Scratch is a colloquial term for abrasion, which is a type of mechanical injury and legally classified as simple hurt, because of no bleed tendency, heal without permanent scars. However corneal abrasion and abrasion on head and face with dermis involvement, both injuries are legally classified as grievous hurt according to Indian law as per Indian penal code section 320 of clause 2 and 6 respectively, as both injuries tend to heal with permanent scar and disfigurement. [1-4] Our case series addresses a gap in existing literature on forensic and medicolegal aspects of abrasions, providing new insights and perspectives for medical professionals and medico legal practitioners.

LITERATURE REVIEW:

1. Overview

Abrasion is defined as the removal of a superficial epithelial layer of skin, usually the epidermis, by frictionagainst a rough surface. [1]For medicolegal purposes each abrasion has to be described separately because the tale of each and every abrasion is different. If abrasion was not appreciated in visible light, ultraviolet light can be used to enhance visibility and its features in detail. [3-5]

2. Types of abrasion

Medically abrasions are classified into five types; Scratch, graze, pressure, imprint, pattern.

I. Scratch abrasion

It also known as by other names Scrapes / Scratches / Linear abrasion. In which length of wound is more than the width and produced by sharp and pointed objects such asfingernails or thorns.

II. Graze abrasion

It is alsoknown by other names Glancing abrasion / Grinding abrasion / Scraping abrasion / Sliding abrasion / Scuff abrasion / Road rash / Gravel rash.Graze abrasion features: It a collection of innumerable scratches, involves larger area of skin, which is uneven longitudinal and parallel lines of grooves or furrows, where starting point shows clear area and ending point shows epithelial tag.

III. Pressure abrasion

It is alsoknown by other names Crushing abrasion / Friction abrasion. Mechanisms in which perpendicular pressure / force acts on the skin will be less and where time of contact will be more. It is the linear or direct pressure of a rough object on the skin with inward direction of movement that results in crushing superficial layers of skin. Examples are Nooses / Ligature mark produced by hanging or strangulation, Corneal abrasion, Teeth bite mark, Shoe bite mark.

IV. Imprint abrasion

It is alsoknown by other names Contact abrasion / Impact abrasion. Mechanisms in which perpendicular pressure / force acts on the skin will be more and where time of contact will be less. It is seen most commonly on the bony prominently. where a thin layer of skin over the bone and devoid of subcutaneous tissues. Abrasion shows depression, which is slightly below the surface of skin. But in imprint abrasion with underlying bruise or localized swelling, depression won't be appreciated.

V. Pattern abrasion

It is due to both pressure and imprint abrasion by perpendicular force, where patterns of weapon / object will be reproduced on the skin and help in identification such as serrated knife, rope, wire, bicycle chain.

Mechanism of abrasion

Injury severity depends on the amount of force delivered to the body. Injuries severity will be reduced if,

- weapon breaks, in which energy transfer for breaking a weapon on impact or for weapon deformation.
- when the time period increases, because the body moves with impact.
- while striking the surface contains gas such as the abdominal region when comparedto the hard surface of the body.
- when contact surface area of the bodyincreasesby a broad weapon or object [3].

Variants of abrasion

a. **Glancing kick:** It the imprint of boot mark with application of tangential pressure.

b. Teeth mark / Bite mark: Common areas include breasts (females) and arms (males). Bite marks are typically U-shaped, 2.5-4 cm apart, with 6 teeth marks (canine-to-canine). Contexts include self-defense, assault, love bites, and child abuse.

c. Nail mark: Also, terms as Semilunar abrasion / crescentic abrasion / Curved scratch. Nail mark able to represent features of assailant nail such that is it long, crooked, broken, irregular.

d. **Friction burns:** Greater force of friction with clothing's covered skin generate heat energy and cause burns in that local area. It is a graze abrasion with burns. No or very few linear marks seen on abrasion, shows feature of thermal burns.

e. **Forcible impact:** Due to large force, it also impacts dermis of the skin. Hence it produces bruise and swelling along with abrasion.

f. **Solid object impact:** Due to heavy weight of object / weapon, abrasion produces only at periphery of the object when contact with the skin.

g. **Rough surface impact:** Due to rough surface of weapon / object with increase in speed / force of movement produce severe abrasion.

h. **Smooth surface impact:** Due to smooth surface, abrasion produces with no marking / pattern. Which make difficult to identify the weapon.

Age of abrasion on gross examination

- Fresh wound - bright red in colour.
- In 1 day – Bright red scab formation, on dries up of blood and lymph.
- In 2-3 days – Reddish brown scab appearance.
- In 4-7 days – Dark brown scab, epithelium grows under scab and cover defect and scab ready to fall off.
- More than 7 days – Scab dries, shrinks, fall off and leaving behind the depigmented area. Gradually pigmentation occur in that area. [3&4]

Healing pattern of abrasion on histopathological examination[3,7-10]

- 4 to 6 hours – Abrasion area shows Cellular infiltration.
- 12 hours – Three layers formation.

o Surface layer- fibrin and RBC's.

o Middle layer- infiltrating polymorphs.

o Deep layer- abnormally staining collage.

- 48 hours – Well-formed scab. Marginal epithelial regeneration begins.
- 4 to 5 days – If abrasion is small, then it will be covered completely by epithelium by this time.

 5 to 7 days – Subepithelial formation of granulation tissues.

 8 days – Reticular fibres appears.

 9 to 12 days – Collagen fibres appears.

 More than 12 days – Regression starts by remodelling of epithelium by thinning out.

Medicolegal aspect of abrasion[1&3]

i. Direction of force / injury: Because of clear starting point and end point with epithelial tag.

ii. Force / Speed of impact: With friction burn and associated bruise, swelling or fracture

iii. Scene of crime: With sticking foreign matters over the wound, explains surface where the person dragged.

iv. Sign of internal injury: Shows the site of impact and serves as an indicator of violence / damage to internal structures.

v. Manner: Accident / Homicidal / self-inflicted

vi. Time of incident / crime: By healing pattern and colour change with time.

vii. Type of offence: Based on the site of abrasion, mainly nail mark and bite mark offence can be distinguished,

a) Homosexuality - abrasion around anus.

b) Sexual assault - abrasion over cheeks, neck, breast, inner thighs.

c) Struggle - abrasion over face.

d) Smothering - abrasion over mouth and nose.

e) Throttling - abrasion over neck.

f) Child abuse -abrasion over ear lobules, posterior arm and thighs.

viii. Causative weapon / object: Abrasion preserves pattern of object very accurately than any other injuries especially pattern abrasion.

ix. Assailant nail and teeth uniqueness: Both nail and teeth mark abrasions give clue on whether the assailant - human or animal and direction of attack.

x. Abrasion on fall: The pattern of abrasions can indicate the circumstances of a fall:

- Unconscious person: Abrasions on forehead, nose, and cheek (forward fall)

- Conscious person: Abrasions on upper limbs, especially palmar surface (attempted to break fall)

- Person under alcoholic influence: Abrasions on back (backward fall due to loss of coordination)

xi. Postmortem abrasion: Whether anyone try to conceal death body by dragging way from crime scene, miss handling, roll down corpse from hill, thrown in water or in forest, where animals gnaw or scratch.

Abrasion artifacts and differentials[1-3]

a. **Postmortem abrasion:** Usually seen over the bony prominences. Which is yellow in colour with no healing or colour change with time, translucent, parchment like with less exudation, scalp lies below the level of skin surface. On microscopic examination no congestion seen.

b. **Perimortem abrasion:** Period just before or just after the death is known as perimortem period. If any injury sustain in that period cannot be distinguish whether it was antemortem or postmortem injury. Even with microscopic examination it can't differentiated.

c. **Decomposition:** If advance decomposition sets in, then it's difficult to examine the abrasion.

d. **Burns:** After death, epidermis of abrasion becomes leathery, parchment like and stiff. Which begin to resemble like burn injury.

e. Gnaw erosions: After death, ant or cockroaches gnaw in any moist areas of skin and skin folds especially mucocutaneous junctions. It will produce whitish or brownish erosions. On magnifying lens examination margins will be irregular or may reveal linear or crescent shaped ant bite mark with no vital reaction.

f. **Napkin rash:** Because of persistence moist due to excreta around napkin area and excoriation, when it dries up, it looks pale yellow to deep copper in colour, parchment like and depressed. which resemble like abrasion injury.

g. **Dry skin:** Mostly in the area of scrotum and vulva due to dry skin on exposed to air and also absents of subcutaneous fats in that area, produce reddish brown or yellowish discoloration. Which resembling abrasions.

h. Bed sore: Seen on pressure points of dependent area with history of bed ridden for longer duration and produce by compression of tissues between bony prominence and external surface.

CASE SERIES

CASE 1. AUTOPSY BASED STUDY - (Railway Tract Injury)

A 25-year-old man, a known alcoholic and drug abuser, was fatally injured by a metallic part of a running train. Autopsy revealed 7 injuries with underlying fractures of skull and brain damage, 5 abrasions with epithelial tags, and friction burns on the left shoulder. These findings helped determine the direction of impact and the train's speed. (Figure 1)

Figure 1. Abrasions, starting and end point with epithelial tag were appreciated. Direction of impact and running vehicle had been ascertained. Figure 2a

CASE 2. AUTOPSY BASED STUDY - (Antemortem Suicidal Hanging)

A 30-year-old man allegedly hanged himself at home using a white drawstring rope. Autopsy findings included a ligature mark on the neck, consistent with the rope material, and a slip knot on the left side. The ligature mark was a pressure abrasion, reddish-brown, dry, and parchmentized. The ligature mark was corresponding with the ligature material. (Figure 2a and 2b)

Figure 2. Ligature material – white colour drawstring / lace rope / nada (made of mixed fabric) Figure 2b

CASE 3. AUTOPSY BASED STUDY - (Fatal Fall from Height)

A 53-year-old man allegedly fell from a balcony while wearing slippery shoes on an uneven surface. He landed on his left forearm, sustaining 11 injuries, including 4 abrasions, with underlying fractures and brain damage. The abrasions, though few, helped recreate the accident scene and explain the manner of fall. (Figure 3a and 3b)

Figure 3. Ligature mark in the form of pressure abrasion was reddish brown in colour, dry, hard, parchmentized. Hanging abrasion was corresponding to the ligature material.

CASE 4. AUTOPSY BASED STUDY - (Road Traffic Accident)

An 18-year-old pedestrian was hit by a four-wheeler, sustaining fatal head injuries with fracture of skull and brain damage. Autopsy findings included:

- Bumper fracture on left tibia (primary impact injury)

- Left-sided head injury (secondary impact injury)

- Peculiar-shaped abrasion (tertiary impact injury) on back with 2D tailing, indicating direction of fall. Despite treatment, he succumbed 12 days later.

(Figure 4)

Figure 4. The kinetic force act on the body due to fall, had stopped suddenly by direct impact of left side of the body on touching the ground, resulting grazed abrasion.

Case 5. Supreme Court Judgment [11]

Mukesh & Anr V. State for NCT of Delhi [2017]6SCC1

The case famously known as 'Nirbhaya Delhi Gang Rape Case 2012' - A 23-year-old girl, on boarding the bus, she was brutally gang raped by 6 men including a 17 years juvenile, physically assaulted, iron rod inserted into her private parts to her intestine also her internal organs and thrown out naked from running bus. On examining various bite marks on the victim which is the form of pattern abrasion, at least three bite marks have been identified to have been caused by one of the accused Ram Singh and one by Akshay. Bite mark analysis along with

fingerprint and DNA profiling helped here in obtaining justice.

Case 6. Shatrughna Baban Meshram V. State of Maharashtra, Criminal Appeal nos.763-764 of 2016 [12]

A two and half-year-old girl child was taken away by the 21-year-old male was taken to the under construction building of Anganwadi. There she was raped and sustained severe injuries. Onmedical examination of the accused found an abrasion injury on the tip of the glans penis of size 5mm X 3mm, along with signs of sexual intercourse. which found to occur within 24 hours. In the child, perineal tear with multiple injuries occurred due to forceful sexual assault and bite marks were also found over the body of deceased victim. Death sentence given to the accused under IPC section 302, 376A and POCSO Act.

Case 7. Javed Abdul Rajjaq Shaikh V. State of Maharashtra Criminal Appeal No. 1181 Of 2011[13]

A 20-year-old woman with two years of marriage has been murdered in demand of dowry by throttling and made as, to believe others as suicidal hanging.

Based on crescentic abrasion (Nail mark) present on left side of neck, extending from centre to lateral about 5cms long, pale pressure (Abrasion) mark present over both legs anterolaterally over ankle region about 7 x 1 cm along with bruising and ecchymosis present on both sides on neck, which were corresponding to internal injuries of larynx, trachea and bronchi. Cause of death as per postmortem report were acute cardiorespiratory arrest secondary to acute asphyxia, secondary to throttling. Manner of death was pinpointed with abrasion injury and court convicted all the accused for the offences.

DISCUSSION

Abrasions are two-dimensional, measurement required length and breadth. [5]On close observation of abrasion in above cases and in general, we are able to find; Direction of force with epithelial tag on end point of injury. Scene of crime by presents of dirt, gravel, grease, sand and mud particles. Time since injury / assault and time of survival after injury can be elicited by colour change and healing pattern of the wound. Manner of injury and death in some extends either accidental, suicidal, homicidal or fabricated. Identifying weapon / object of crime is very much possible with abrasion, as it preserves pattern of object more accurately than any other injuries. [1-4]

CONCLUSION

Abrasion examination does not require complex tools and instruments, just alert bare eye inspection on postmortem examination is sufficient but if aided with a magnifying lens maybe of 3X and vision on UV light yields an extra edge regarding abrasion interpretation per se. Abrasion injuries are almost not fatal in nature and don't contribute to cause of death except a few circumstances like an infected wound, [6] but it gives crucial information for clinical and medico legal works. Every big problem has a simple solution and a small key opens big doors, similarly unsolved mysteries forensic cases can be solved with simple injury such as abrasion.

CONFLICT OF INTEREST: NIL

SOURCE OF FUNDING / SPONSORSHIP: NONE

Figure 5. It explains the manner of fall and help in recreation of accident. Figure 4

Figure 6. Abrasion over back in peculiar shape (tertiary impact injury) due to uneven surface impact on grounding of the person.

REFERENCES

Gautam, B. (2021). *Review of forensic medicine & toxicology: Including clinical and pathological aspects* (6th ed.). Jaypee Brothers Medical.

Dikshit, P. C. (2023). *Textbook of forensic medicine and toxicology* (3rd ed.). Peepee Publishers.

Aggrawal, A. (2021). *Textbook of forensic medicine and toxicology* (2nd ed.). Avichal Publication Company.

Chand, S. (2023). *Essentials of forensic medicine* (2nd ed.). Elsevier Health Sciences.

Saukko, P. J., & Knight, B. (2016). *Knight's forensic pathology* (4th ed.). CRC Press.

Shrestha, R., Krishan, K., Ishaq, H., et al. (2023). Abrasion. In *StatPearls*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK554465/

Gonzalez, A. C., Costa, T. F., Andrade, Z. A., & Medrado, A. R. (2016). Wound healing: A literature review. *Anais Brasileiros de Dermatologia, 91*(5), 614–620.

Shaw, T. J., & Martin, P. (2009). Wound repair at a glance. *Journal of Cell Science, 122*(18), 3209–3213. https://doi.org/10.1242/jcs.031187

Gurtner, G. C., Werner, S., Barrandon, Y., & Longaker, M. T. (2008). Wound repair and regeneration. *Nature, 453*(7193), 314–321. https://doi.org/10.1038/nature07039

Robertson, I., & Hodge, P. R. (1972). Histopathology of healing abrasions. *Forensic Science International, 1*(1), 17–25.

Mukesh v. State (NCT of Delhi), (2017) 6 SCC 1 (Supreme Court of India).

Shatrughana Baban Meshram v. State of Maharashtra, (2021) 1 SCC 596 (Supreme Court of India).

Javed Abdul Rajjaq Shaikh v. State of Maharashtra, Criminal Appeal No. 1181 of 2011 (Supreme Court of India).

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