Section: Forensic Medicine & Toxicology

Case Series

POSTMORTEM TANNING: CAN IT HELP IN ESTIMATING TIME SINCE DEATH?

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ABSTRACT

Postmortem tanning appears as sharply defined, tanned and peeled skin patches on sun-exposed areas within 24 hours after death. It was observed in seven cases, with sun exposure ranging from 2 to 12 hours and temperatures between 200 C and 400 C. Tanning sometimes occurred even under clothing, and affected areas often showed early decomposition. The exact cause is unclear, as tanning usually requires metabolism, but environmental factors like sunlight heat may play a role. Histological studies are recommended to clarify the mechanism and rule out artefactual drying. Postmortem tanning could help estimate the postmortem interval and improve forensic scene analysis. Further research is needed to understand this phenomenon in forensic pathology and dermatology.

Keywords: Postmortem, tanning, sun burn, time since death, handling.

INTRODUCTION

The estimation of the postmortem interval is a critical component of death investigations, as it plays a pivotal role in establishing responsibility for the cause and manner of death. However, it is a well-established fact that no existing method can accurately determine the exact time of death. Universal identification of certain postmortem changes is important in evaluation of the conditions, timing and potential events, like body movement, within postmortem interval.[1]

Skin and mucosa of living people are humid and kept humid by transudation, secretion of sweat and mechanical humidification by movement of eyelid or tongue. These processes stop with death. Additionally, hypostasis causes dehydration in epistatic regions of the body. The surface humidity of uncovered skin and mucosa evaporates rapidly dependent on-air movement, humidity and heat.2 Cooling of body and rigor mortis have distinctive appreciation in forensic literature for estimating postmortem interval, but many factors influence their estimation in early hours of death.

In this case series, we report 7 cases of postmortem tanning, all involving tanned transformation of skin exposed to sunlight for considerable period within 24 hours of death, producing well-demarcated lines and patches with peeling of skin due to postmortem handling at the scene and at mortuary. A previously published case report addressed this novel postmortem phenomenon of tanning and recommended that, this subject should be further investigated for its potential utility in postmortem scene analysis.[2,3]

CASE 1

In second week of December, a 35-year-old man was found deceased at the jungle-unmanned area which was located at the outskirts of his resident city. There were a Celphos (aluminium phosphide) tablets packet and a disposable glass found nearby the body. He was last seen at his home approximately 28 hours before being found. The same afternoon, he was transported and was kept in cold storage overnight.

On next afternoon, at the autopsy was performed. The man was dressed in black sleeveless sweater, striped full shirt, black trousers, brief and trunk. Complexion

of the skin over non-exposed part was fair. Peeling and darkened skin tags were present over right upper-back and lateral aspects of trunk [Figure 1]. Distribution of the hypostasis was well marked over face, front of trunk and both upper-lower extremities. There was a solitary early putrefactive blister present at right flank.

The autopsy findings were notably to scattered abrasions over face, upper-lower extremities and right ring finger with contused upper lip mucosa. Petechiae were present over both lungs and heart at discrete places. Cerebral and Pulmonary oedema was present with stomach contents being brownish fluid with aromatic odour accompanied mucosal congestion. The final cause of death was due to aluminium phosphide poisoning and manner was attributed as suicidal.

Figure 1: Tanned transformation with faint tanned and peeling of skin (Case-1)

CASE 2

On an afternoon of first week of February, a 50-year-old deceased female was brought for autopsy. She was a habitual alcoholic and was found without signs of life, along the road of the locality at about 6:15 PM that day. The body was kept in freezer over-night. The examination began about 18 hours later to its storage.

Figure 2: Brownish discolouration with peeling of skin and redness (Case-2)

On external examination, the woman was dressed in Saari which was tucked over knees and half-sleeve blouse without footwear and stockings. No external signs of injury and decomposition was present. The hypostasis was noted over back of torso. Brown pigment transformation was noted over anterior aspects of left arm [Figure 2] and right leg below knee [Figure 3]. There was peeling of skin with redness underneath over arm and comparatively lesser degree of redness was present over right leg. A distinct line of demarcation could be seen. The skin was darkened compared to other area of leg. Notably, these areas were exposed to direct sunlight.

Autopsy findings were consistent with Cerebral and Pulmonary oedema without any peculiar odour from stomach contents. Manner of death was attributed as natural.

Figure 3: Tanned demarcation zone of right leg and peeling (Case-2)

CASE 3

The third case was a deceased male CRPF jawan, who had sustained firearm injuries during sudden attack of local extremists and was found deceased at the jungle site. The autopsy was performed about 16 hours after death without any storage. The time of the year was second week of March.

Figure 4: Tanned transformation of torso (Case-3)

The individual was dressed in Force uniform dress involved Full sleeves shirt and trousers. There was no external sign of decomposition. Dark brown demarcated patches were observed over front of torso [Figure 4] and front of both lower extremities from

thighs to the legs [Figure 5]. There was shrunk wavy pattern of wrinkling of superficial layers of skin. Yellowish discolouration of skin was noted over chest and whitish discolouration was noted over the peeled skin regions of left arm and both legs. The cause of death described as firearm injury to the Chest.

Figure 5: Tanned transformation of Lower extremities (Case-3)

CASE 4

During second week of April, an another 30-year-old male force jawan, who sustained firearm injury during sudden ambushed attack of extremists at the evening hours. The autopsy was performed about 13-16 hours after death.

Figure 5: Left thigh-peeled skin and yellowish appearance (Case-4)

Figure 6: Right thigh- darkened skin tags (Case-4)

The individual was wearing a uniform full sleeves T-shirt and trousers. There was no sign of decomposition. Anterior aspects of both thighs showed similar skin tags with dark brown discolouration and peeled off pattern. Yellowish discolouration of subcutaneous area was like earlier noted Case 3.

Abrasions and bruises are found over face, torso-front and back. The firearm injury to the chest was cause for his death.

CASE 5

The fifth case was a 35-year-old transported to emergency department in an unconscious state. He was found hanged at his residence in morning hours of October. He survived up to about 55 hours. The deceased was preserved in freezer. Autopsy was performed about 20 hours thereafter.

On examination, he was dressed in boxers only. Anterior aspects of right arm showed peeling of skin, wrinkled tanned skin tags and pale area. The forearm skin showed wrinkling darkened skin. It was confirmed that, the body was rested over mortuary ceramic platform for about 2-3 hours prior by police. There was east facing window nearby, which had direct sunlight projecting towards right arm. The abraded ligature mark was present over neck. The abrasions were present over both elbows. The Cerebral oedema, petechial haemorrhages over myocardium were present. The cause of death was ascertained as Complications of Hanging.

Figure 7: Right arm and forearm show peeling and brownish tanned wrinkling (Case-5)

CASE-6

A 37-year-old CRPF man was on routine search operation at jungle region in morning hours of April. His group was suddenly attacked by local extremists group causing firearm and blast injuries. He had sustained firearm injury to the head and died at the site.

The autopsy was performed about 10-12 hours post-incidence. He was dressed in uniform full sleeves T-shirt, Full Trousers and undergarments. There was bloating observed over abdomen due to collection of putrefactive gases. The anterior aspects of right arm showed similar peeled off skin with darkened skin tags [Figure 8]. The tattoo underneath was clearly visible. The right upper back also showed peeled of skin with pale area.

Figure 8: Peeled off skin with tattoo (Case-6)

Figure 9: Peeled of skin over non-dependent region (Case-6)

CASE 7

In similar incidence as mentioned in case 6, the decedent was a 37-year-old male, died due to Firearm injury to the trunk. He was dressed in Force uniform which include, full sleeves T-shirt, trousers and undergarments. The autopsy was performed about 12-14 hours. The back of torso showed dark tanned region with similar looking peeling of skin. It was a dependent region, which was confirmed by extent of post-mortem lividity over front of torso.

Figure 10: Back of torso (Case-7)

DISCUSSION

During life, exposure to sun's ultraviolet A and ultraviolet B (UVB) rays results in the processes of both immediate and delayed tanning.[4] Immediate tanning occurs within minutes and can last up to 1 day. It is postulated to be driven primarily by ultraviolet A light, resulting in the oxidation and dispersion of preexisting melanin granules.[5] In contrast, delayed tanning is characterized by increased melanogenesis driven by UVB rays, beginning within days of sun exposure and persisting for up to weeks or months.[5] Specifically, delayed tanning involves UVB-induced damage, which leads to increased expression of p53 and subsequent upregulation of the rate-limiting enzyme of melanin synthesis, tyrosine. It also leads to activation of keratinocyte-derived melanogenic factors (melanocyte-stimulating hormone, basic fibroblast growth factor, nerve growth factor, proopiomelanocortin).[4,5] Altogether, these responses act to increase melanocyte-facilitated synthesis of melanin. Newly synthesized melanin accumulates within melanosomes, which are then transported to keratinocytes within epidermis. Here, the melanin surrounds the nucleus and functions to scatter and absorb UV light to protect keratinocytes from future UV-induced damage.[5]

We report 7 cases of postmortem tanning with the range of episodic sunlight exposure that each decedent's body experienced ranged from approximately 2 hours to 12 hours in months of February, March, April, October and December. Decedent described in case 1 was found in peak winter period in an open area in prone position. Probable sun exposure could have been up to 4 hours with moderately clothed attire. Case 2 described, exposed parts of body such as left arm and right leg had tanned area with peeling of skin due to handling. Case 3,4,6 and 7 decedents belonged to special force defence personnel. We found that even skin covered by clothing became tanned, and the outer skin layer became soft and loose, peeling off when the body was handled. Case 5 represented, about 3 hours of exposure to right arm showed tanned zone. It is clear from all cases; sufficient time had existed for mechanisms of immediate tanning to occur.

Physical appearance of postmortem tanning is clearly demonstratable. But the question always remains, that how this phenomenon occurs physiologically. Ultra-violet induced DNA damage and the subsequent activation of various melanogenic factors is an enzyme-driven process, thus leading us to wonder how this can occur in an individual whose metabolism has ceased.[3] Our study reports, the environmental temperature could had been between 20 degree Celsius to 40 degrees during that time-period. In contrast, longer freezing environment exposure were reported from 8 hours to 8 days in earlier case study. They hypothesized, this colder environment might had led to preservation of enzyme driven process, required for tanning. It is clear from this study that, sun exposure for up to 6 hours was sufficient for dark transformation. From 6 to 12 hours period, there was loosening and wrinkling of epidermal layer from the tanned area. This shows,

loosening of skin layers and acceleration of early decomposition process due to tanned area. It can also be attributed to rapid activity of bacteria due to raised surface temperature of those exposed area. Early external signs of decomposition, as widely documented in forensic literature, typically include the appearance of greenish discoloration of the skin in flank and hypogastric regions. The pale or yellowish area underneath peeled skin represents non-vitality. Ante-mortem tanning of exposed body area is the most frequent finding noticed by author at autopsy, but the clear-confined area of tanned skin and peeling demonstrates early postmortem change.

Present work reports cases postmortem tanning. Our current hypothesis is consistent with usual tanning, characterized by UV-induced increase in melanin and subsequent perinuclear protection of keratinocytes, as well as possible acceleration and amplification of this process by hotter exposure. However, further study into pathophysiology of postmortem tanning is necessary to fully understand the phenomenon. It is suggested for histological examination of tanned skin, unaffected skin and lines of demarcation. It will help to identify if there is any increased presence of melanin granules. Comparison must be made with levels of moisture at affected and un-affected regions of tanned skin. It will aid in ruling out possibility of artefactual drying.[3]

CONCLUSION

In conclusion, more morphological-histological studies and collaborated approach are needed to further confirm and explore this novel postmortem phenomenon within forensic pathology community and dermatology. It could assist in understanding this postmortem change in general and specifics of postmortem interval and environment.

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