

## Cause of Death (Including Open, Exposed Injuries) and Clothing Status of Corpse vis-a-vis Decomposition of Human Bodies

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### Abstract

**Introduction:** Decomposition Changes in the corpse is the final stage of degradation of the body. These changes sets in after disappearance of rigor mortis where by complex organic structures are broken down into simpler variants by the action of anaerobic bacterial flora and autolytic digestive action of enzymes outpoured during cellular death. Concealment of crime by hiding the bodies is a common practice. Often these bodies are found in various stages of decomposition at the time of recovery. Injuries (including open wounds) over body surface attract insects and provide warm and suitable micro-environmental conditions for eggs laying, in addition to natural and cozy body orifices.

**Aim:** The objective of the present study is to correlate the cause of death (including open wounds) with respect to decomposition of human bodies, to study the distribution pattern of injuries over body and to find effect of clothing status on the overall decomposition process.

**Material and Methods:** The present study was carried out during 2009-2012 and involved 100 human corpses in various stages of decomposition. All necessary and vital information was assembled from police papers regarding location of body, crime scene, last seen alive etc. History narrated by relatives was correlated with the condition of the body and police history. Cases were classified according to their status of decomposition, clothing status of the corpse was identified as partial, complete and naked. Injuries present were recorded according to their size and location.

**Observations and Results:** Out of the total 100 cases studied, 6 cases were in stage 1, 31 in stage 2, 34 in stage 3, 25 in stage 4 and 4 cases were in stage 5. 55 cases were fully clothed, 28 cases partially clothed while 17 cases were naked. In 25% cases injuries were cause of death. In 10% cases pathology and infection was cause of death. In 44% cases head (including face) & neck was the commonest site of injury. 60% cases of injuries were recorded in month of April to September. 82% of bodies found naked were recovered in advanced stages of decay.

**Conclusion:** The present study highlights that while injuries are a definitive additive parameter to the process of decomposition, other cause of death also influence rate of decomposition of human corpses. Injuries, particularly in combination with other suited conditions over various body parts ideally allow for the growth of various predators and work cumulatively in ultimate demolition of the body. Exposed corpses were found especially susceptible to alterations in any given conditions.

**Keywords:** Decomposition, Injuries, Micro-environmental conditions

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### Introduction

Decomposition changes in the corpse is the final stage of degradation of the body. These changes sets in after disappearance of rigor mortis where by complex organic structures are broken down into simpler variants by the action of anaerobic bacterial flora and autolytic digestive action of enzymes outpoured during cellular death. As the stage progresses a series of visible changes take place in the corpse, including marbelling, bloating of body (due to gases produced during anaerobic activity), peeling of skin, blister formation, loosening of nails, hairs and teeth, softening of internal

organs and finally skeletonization. Similar changes occur in internal organs sequentially. They act in addition to undergoing cellular changes and add to the destruction process. Flies lay eggs in clusters at times and singly on other occasion in hairs, nostrils and body cavities completing their life cycle. During this process, they utilize human tissues as resources and feed upon them.<sup>(1)</sup> The corpse is attractive to a number of invader organisms during these phases involving flies and other terrestrial habitants. Researchers have classified these changes into 5 different classes, though the line of separation is fine.<sup>(2)</sup>

In turn, a number of parameters affect this process through these different phases, the most important factors being those of temperature, humidity, entry of air and light, clothing's, body distribution of fat, the cause and manner of death.<sup>(3,4)</sup> In cases of death due to preexisting infections, septicemia etc. the decomposition changes accelerates. On the other hand decomposition rate decelerates in cases of poisoning due to heavy metals, as they exert preservative action

on the tissues, in addition to destruction of affecting microorganisms.<sup>(4)</sup> In case of burnt bodies the surface of bodies becomes non attractive to external intruders due to coagulation of proteins thereby retarding process of decomposition.<sup>(5)</sup> Injuries (including open wounds) over body surface attract insects and provide warm and suitable micro-environmental conditions for eggs laying, in addition to natural and cozy body orifices.<sup>(6)</sup>

The size of the corpse can alter the overall process of decomposition by limiting the availability of food for the larvae thriving on the body, usually though it does not affect the life cycle of a fly.<sup>(7,8)</sup> Mode of death is an another determinant in influencing decomposition as in cases of CO poisoning, the changes in the constitution of Hb affects the cellular response. Clothing's worn over body preserve body heat and thus favour putrefactive changes. However, very tight clothing's diminish putrefaction due to relative bloodlessness in the area. Naked corpses are easily approached by organisms and thus the process of decay is affected.

The objective of the present study is to correlate the cause of death (including open wounds) with respect to decomposition in human bodies, to study the distribution pattern of injuries over body and to find effect of clothing status on the overall decomposition process.

### Material and Methods

The present study was carried out during 2009-2012 and involved 100 human corpses in various stages of decomposition. All necessary and vital information was assembled from police papers regarding location of body, crime scene, last seen alive etc. History narrated by relatives was correlated with the condition of the

body and police history. The cases were classified into one of the five visible categories of decay:

**Stage 1:** Fresh (involving earliest signs of decomposition including greenish discoloration of flanks, marbelling), **Stage 2:** Bloated (involving features of body bloating)

**Stage 3:** Active decay (involving cases post bloating and release of putrefactive gases),

**Stage 4:** Post decay (involving cases with major reduction of corpse volume and loss of internal structures),

**Stage 5:** Skeletonization.

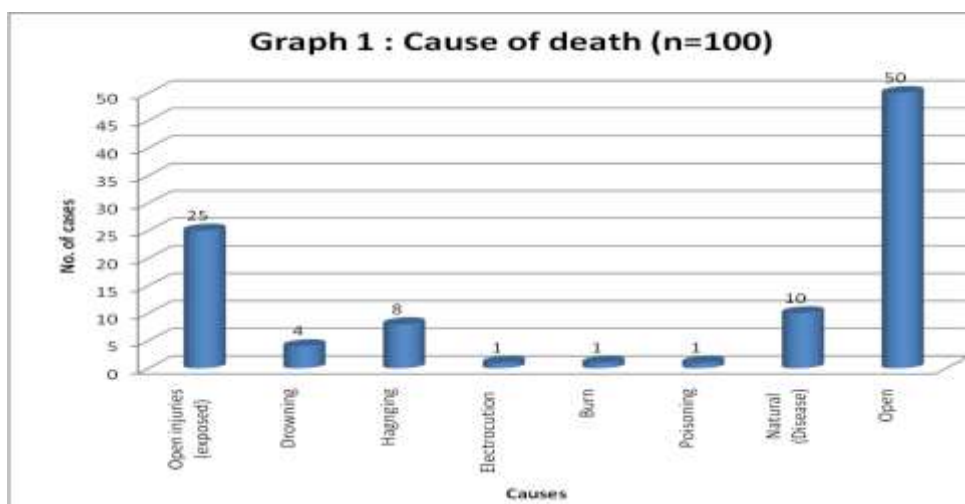
Clothing status of the body was recorded and classified as:

1. Fully clothed (involving garments all over upper and lower segments of body/full body),
2. Partially clothed (involving cases where clothes were present over either upper or lower segment including wearing inner wears),
3. Nude (involving bodies found naked).

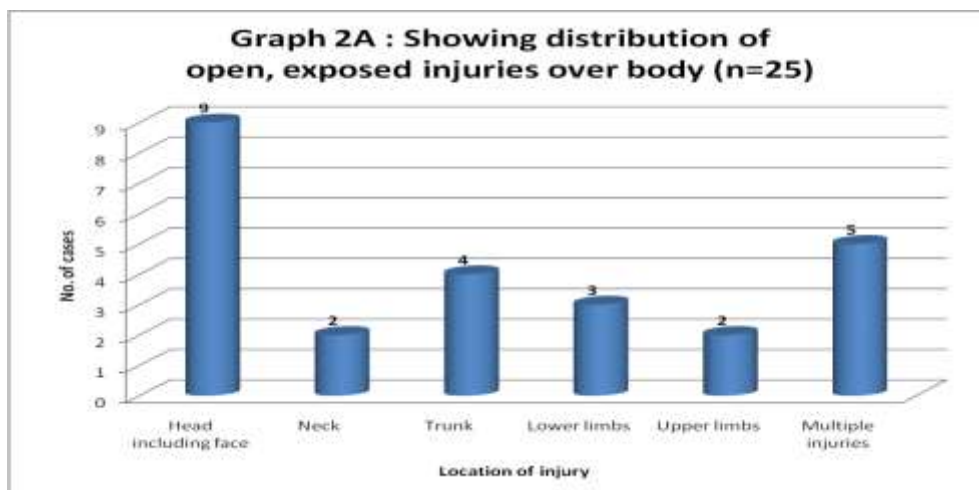
A meticulous examination at autopsy was done to find out the cause, mode and manner of death. Injuries present over body were recorded according to their size and location. Related climatological data was gathered from local meteorological records. All information thus gathered was subjected to interpretation to arrive at the goals of present study.

### Results and Discussion

Out of the total 100 cases studied, 6 cases were in stage 1, 31 in stage 2, 34 in stage 3, 25 in stage 4 and 4 cases were in stage 5. 55 cases were fully clothed, 28 cases partially clothed while 17 cases were naked.



**Graph 1**



Graph: 2

Table 1: Season Distribution of Cases with open, Exposed Injuries (n=25)

Seasons	No. of cases
April - June (Summer)	06
July – September (Rainy)	09
October (Autumn)	03
November – January (Winter)	04
February – March (Spring)	03

As is clear from the Graph No. 1 out of the total 100 decomposed corpses, open injuries were cause of death in 25% cases while natural disease (Pathology & infections) was cause of death in 10% cases. 8% of cases were deaths due to hanging. The commonest sites of open injuries included head (including face) & neck. Together they amounted for 44% of all open injury cases and were very heavily infested with flies & eggs. Hence, it follows that in addition to other natural micro climatically protected orifices of the facial skeleton open and exposed injuries were a major source of attraction for invaders and subsequent decomposition. 20% of cases with open injuries were present over upper and lower limbs and these cases involved crushed, lacerated and avulsed injuries and various larval forms thrived over these sites. Another 20% of cases of injuries involved multiple wounds over body. Thus, exposed injuries anywhere over the body were preferred locations for insect activity. Different life cycle stages of flies and thus decomposition of corpse is delayed in woundless bodies.<sup>9</sup> 60% of cases with open injuries related cases were present in months of April – Sept. in the settings of super added favourable environmental condition (of temperature and humidity).

Table 2: Showing Stage wise Distribution of Casue of Death

Stage	Various Casue of death							
	Open Injuries (exposed) N = 25	Drowin g N = 04	Hangin g N= 08	Electrocutio n N = 01	Natural N = 10	Burn N=01	Poisioni ng N= 01	Open N= 50
Stage1 (06)	01	01	03	-	01	-	-	-
Stage 2 (31)	10	02	02	01	04	-	01	11
Stage 3 (34)	07	01	01	-	04	01	-	20
Stage 4 (25)	05	-	02	-	01	-	-	17
Stage 5 (04)	02	-	-	-	-	-	-	02

Total of 56% of cases with injuries as casuse of death were noted to be present in stage- III and above of decomposition thereby suggesting that injuries add to the process. In drowning deaths, however, the bodies were found in earlier stages of decomposition which may be due to the fact that after bloating the bodies afloat. In natural death cases the distribution pattern was rather equitable all along the decay stages. However, cases in early stage were having normal/non infective pathology. Hanging death were sperad along entire duration of decay and involved cases recovered from closed room to bodies found hanging on trees in open. One cases of burn injury with

coagulation of surface protein was found in stage III of decay. Earlier researchers also mentions that cause of death is a modulatory factor determining decomposition rate.<sup>(10)</sup>

**Table 3: Showing Stage Wise Clothing Status**

Stage	Clothing Status		
	Fully clothed N = 55	Partially clothed N = 28	Naked N = 17
Stage 1 (06)	04	02	-
Stage 2 (31)	18	10	03
Stage 3 (34)	20	10	04
Stage 4 (25)	13	05	07
Stage 5 (04)	-	01	03

In 60% of fully clothed bodies the corpse was in the distal half of decomposition process (Stage III & IV). 57% of partially clothed cases belonged to stage III and above. Total of 82% naked bodies were found in stage III and above. It thus infers that naked bodies are more vulnerable to changes and most affected by decomposition process. Scavenger modifications bring out changes in exposed corpses there by influencing decomposition rate.<sup>11</sup> Flies gain quick access to nude bodies and oviposit very soon signaling decomposition cascade.<sup>12</sup>

### Conclusion

The present study was sought to find the various causes of death and their relationship with stage of decay. While almost all common causes of death were observed in decomposed bodies, cases with open injuries revealed definite positive correlation to the over all process of decomposition, as these bodies were found to attain higher stages in relation to bodies having other causes of death. Open exposed injuries over head (including face) and neck provided ideal breeding grounds for various predator species to thrive in matching surrounding conditions. However, open exposed sites anywhere over body correlated well with decomposition status of the body. Corpses without clothing were found specially susceptible to alterations in any given conditions.

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